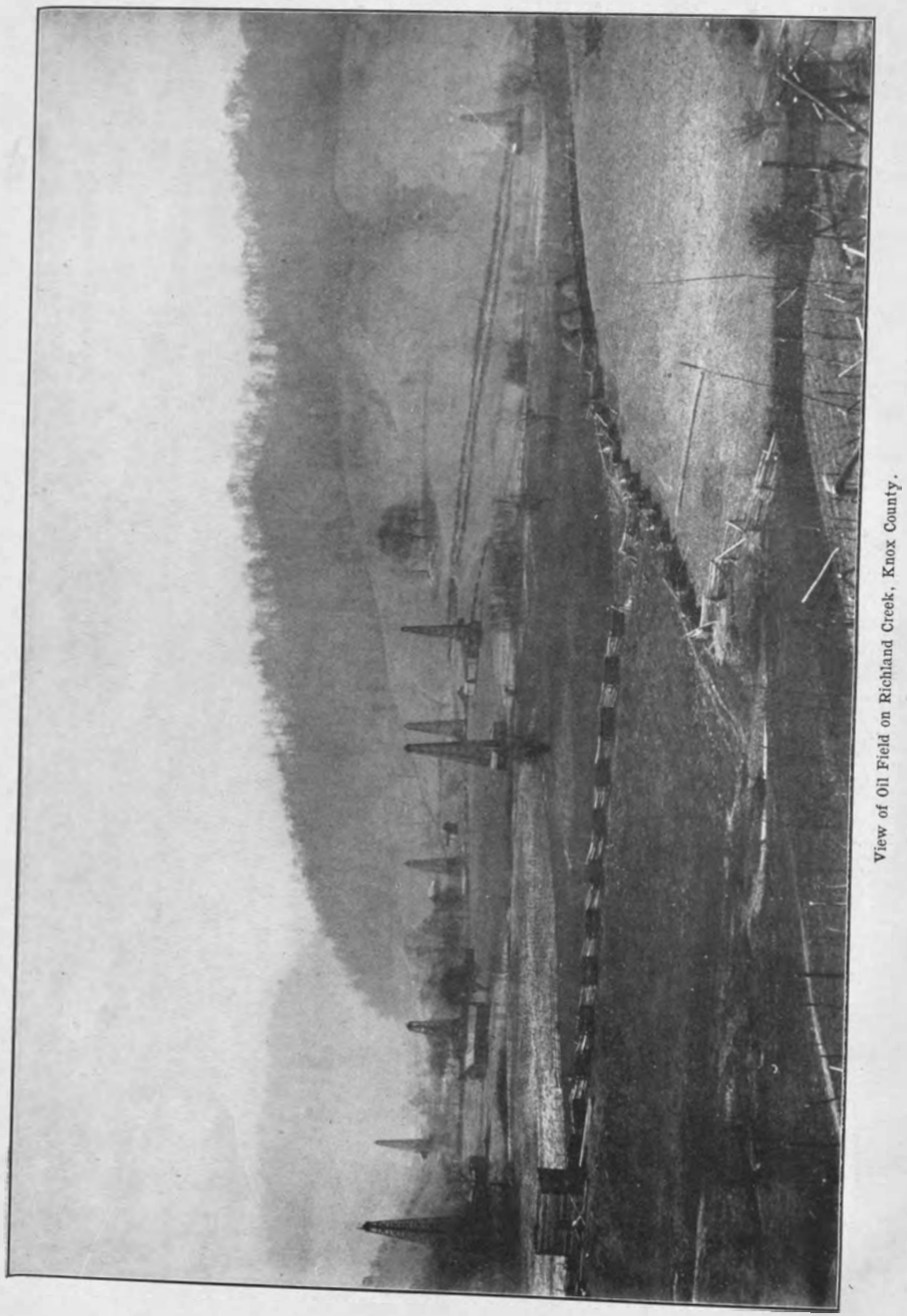

View of Oil Field on Richland Creek, Knox County.

GEOLOGICAL SURVEY OF KENTUCKY.

CHARLES J. NORWOOD, DIRECTOR.

THOMAS L. WATSON,
VIRGINIA POLYTECHNIC INSTITUTE,
BLACKSBURG, VA.

BULLETIN NO. I.

PRELIMINARY PART.

THE

OIL AND GAS SANDS OF KENTUCKY,

BY

J. B. HOEING, C. E.

OFFICE OF THE SURVEY: LEXINGTON.

1904.

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Letter of Transmittal.

To His Excellency, J. C. W. BECKHAM,

Governor of Kentucky.

Sir: I have the honor to submit herewith a preliminary report on the Oil and Gas Sands of Kentucky, by Mr. J. B. Hoeing, assistant geologist.

As indicated in the title, the report is a preliminary part of Bulletin No. 1, the Act governing the Survey providing that "in cases of urgency the Director may issue preliminary parts of a bulletin, covering the special work so far as it has progressed, in advance of the completion of the entire bulletin." The insistent calls for authentic information concerning our stores of petroleum and gas, and the pressing need of a more intelligent system upon which to base development, which is so keenly felt by those who are engaged in prospecting the State, certainly present a case of "urgency," and I therefore respectfully ask that the report be published as expeditiously as possible.

It will be observed that in this report Mr. Hoeing has provisionally retained the nomenclature of the late William M. Linney, a former assistant geologist on the Kentucky Survey, for certain geologic formations, such as Hudson, Waverly, etc., which must now be discarded. The "Hudson" of Linney, for example, must be replaced by "Cincinnatian," with certain of its various subdivisions. The names used by Linney have been provisionally retained here not only because those terms are somewhat familiar to oil well drillers in the State, but because the Survey is not yet ready to present the revised nomenclature upon which work is now in progress. In the final bulletin the revised nomenclature will be used, correlated with the Linney names.

Comparatively little concerning the oil possibilities of that part of the State west of the Louisville and Nashville division of the Louisville & Nashville Railroad is given in this report. This is due to the fact that comparatively little has been done in the way of prospecting that part of the State, and I have deemed it highly important that publication of results obtained in the study of those regions which are now of especial interest to investors shall not be delayed until the study of the western districts can be completed. Work in the western districts has been taken up, and it is believed that the Survey will be able to render valuable service in directing prospecting there. Hitherto, prospectors for oil in the western counties have, as a rule, been content to stop at the Devonian Black Shale; but, as appears in this report, that formation is of less importance as an oil horizon than any other one we have.

Very respectfully,

CHARLES J. NORWOOD,
State Geologist.

Lexington, Ky., October 1, 1904.

INTRODUCTORY LETTER.

Professor CHARLES J. NORWOOD,
Director, Kentucky Geological Survey.

Dear Sir: I have the honor to submit herewith a preliminary report on the Oil and Gas Sands of Kentucky.

Acknowledgments are due the many operators and drillers in the State who have kindly placed the records of their work at the disposal of the Survey, thereby rendering this report much more complete than otherwise would have been possible.

Respectfully,

J. B. HOEING,
Assistant Geologist.

Lexington, Ky., October, 1904.

CHAPTER I.

PRELIMINARY DISCUSSION.

Work in the oil and gas fields of Kentucky within the last three years has been progressing at a rapid rate, a large amount of capital has been invested, and the question of the future development of these and the, as yet, untested fields of the State, is one of large and increasing interest; and, when the vastly increased demand for these products and the fact that the older fields in some of the other States are rapidly failing in their supply are considered, is one of great importance to the State. Unfortunately for all concerned, the work of the State Geological Survey was discontinued some years ago by the failure of the Legislature to appropriate the necessary funds, and since that time nothing has been done by the State to help develop her mineral resources. The result has been, in the oil and gas developments particularly, that a great deal of valuable information has been lost, that most of the work done has been almost entirely on the "wildcat" plan, and that large amounts of money have been wasted in drilling wells where there was no possible chance for oil or gas; in drilling below all probable chances; and in drilling wells and stopping short of one or more known oil sands. It is a safe assertion that, with the work of the State Survey going on and with the proper geological advice, the greater part of this money could have been saved and directed into channels where the chances, at least, for profitable returns would have been much greater. It is only necessary to cite the result of such geological work in the neighboring State of Ohio, for instance, as a proof of this assertion.

In issuing this preliminary bulletin it is recognized that much remains to be learned about the oil and gas rocks of Kentucky, and that, as data are collected of work already done and future work is carried on, much that is now in doubt will

be cleared up and much more information made available in regard to the known oil horizons, and new fields, and possibly new sands, developed. In view, however, of the facts above stated, it is deemed advisable, without attempting to go into the detailed description of the geology of particular fields, to give all possible information in regard to the oil sands already known, with their positions in the geological section, and, as fully as possible, the limits within which they occur and the approximate depths at which they may be found in any particular section.

There has been, and is still, great confusion in the minds of many drillers and operators in regard to the positions in the geological section of our Kentucky oil sands. In the effort to trace and correlate the familiar Ohio, West Virginia and Pennsylvania sands with those found in this State a great deal of unnecessary work has been done, and often territory condemned because it proved entirely different from the known fields in other States. Not being acquainted with our geological section, the driller from Pennsylvania, familiar with the oil sands there and the formations between them, and expecting to find the same sands here, gets "lost" and discouraged. The "Gordon," "Gantz," "50-foot," etc., of the older fields are confidently identified in some sand which really has no relation whatever to them, and the resulting confusion leaves the whole field in doubt. The writer has frequently heard operators and drillers from other States, after identifying some Kentucky formation, to their own entire satisfaction, as a "Bradford," "Venango," or some other sand with which they happen to be familiar elsewhere, condemn the whole field as "broken" and unreliable because the rest of the section proved entirely different from what it should have been had their identification been correct.

In order to demonstrate as plainly as possible the connection between the Kentucky fields and those of Ohio, West Virginia, and Pennsylvania, I have prepared the following geological sections for those States, together with the corresponding oil sands for each. For data in regard to the other States I am indebted to reports by Professor Orton and Professor Bownocker, of the Ohio Survey, and Professor White, of the West Virginia Survey.

Ohio Series and Principal Sands.

System	Series		Sands
Carboniferous.	Coal Measures.		Goose Run. Mitchell. First Cow Run. Macksburg, 500 foot. Second Cow Run.
	Pottsville Conglomerate.		Salt. Maxton.
Sub-Carboniferous.	Maxville Limestone. Mountain Limestone.		None.
	Waverly	Logan Group.	Keener. Big Injun. Squaw.
		Cuyahoga.	None.
		Berea.	Berea Grit.
		Bedford.	None.
Devonian.	Devonian Shales.		Ohio Black Shale.
	Devonian Limestones. (Corniferous, Upper Helderburg.)		None.
Upper Silurian.	Lower Helderburg.		Lower Helderburg.
	Niagara.		None.
	Clinton.		Clinton.
	Medina.		None.
Lower Silurian. (Ordovician)	Hudson.		None.
	Utica.		None.
	Trenton.		Trenton.

West Virginia Series and Principal Sands.

System	No.	Series	Sands
Carboniferous.	XV	Monongahela River. Upper Productive C. M.	Carroll—Uniontown.
	XIV	Elk River. Lower Barren C. M.	Morgantown—Little Dunkard. Mahoning—Dunkard—Cow Run.
	XIII	Allegheny River Lower Productive C. M. Great Kanawha Series.	Second Cow Run. Freeport Gas Sand.
	XII	Pottsville Conglomerate. New River Series Pocahontas Coal Series.	Gas Sand. Salt Sands. Maxton (Cairo?) Sand.
Sub-Carboniferous.	XI	1 Mauch Chunk. 2 Mountain Lime. Greenbrier Lime. Big Lime.	None.
	X	Pocono.	Keener. Big Injun. Squaw. Smith's Ferry. Berea Grit.
Devonian.	IX	Catskill.	First—Gantz—100 Foot. 50 Foot. Second—30 Foot. Stray. Gordon Stray—Campbells Run. Third—Whetstone Run Gordon. Fourth—Flat Run Gordon. Fifth—McDonald. Sixth—Bayard—Elizabeth.
	VIII	Chemung and Hamilton.	Practically None.

Pennsylvania Series and Principal Sands.

System	No.	Series	Sands	
Carboniferous.	XV	Monongahela River. Upper Productive C. M. (Pittsburg Coal at Base)	None.	
	XIV	Elk River Series. Lower Barren C. M.	"Hurry Up" Sand. Mahoning—Dunkard.	
	XIII	Allegheny River Series. Lower Productive C. M.	Lower Freeport—2d Cow Run.	
	XII	Pottsville Conglomerate.	Tionesta or Johnson Run. Upper Salt Sand. Middle Salt Sand. Lower (Maxon?) Salt Sand.	
Sub-Carboniferous.	XI	1 Mauch Chunk. 2 Mountain Lime. Greenbrier Lime. Big Lime of Drillers.	None.	
	X	Pocono.	Keener. Big Injun. Squaw.	
Devonian.	IX	Catskill.	Venango Group.	Upper Gas Sand. Butler Co. Gas Sand. First—Gantz—100 Foot. 50 Foot. Second—30 Foot. Boulder. Third—Gordon. Stray Third. Fourth. Fifth. Bayard. Sixth—Elizabeth.
	VIII	Chemung.	Warren and Bradford Groups.	

Kentucky Series and Corresponding Oil Sands.

System	Series	Sands	Remarks
Carboniferous.	Coal Measures.	None known as yet.	
	Conglomerate Measures. Shales, Coals and Massive Sandstones.	Beaver, Horton, Pike, Salt } Of Floyd, Pike etc. Wages, Jones, Epperson } Of Knox Co.	Corresponds in part to Pottsville Conglomerate of Ohio, West Virginia and Pennsylvania.
Sub-Carboniferous. (Mississippian.)	Chester Group. Shales, Limestones and Sandstones.	None known as yet.	Corresponds to Mauch Chunk Shales of West Virginia and Pennsylvania.
	St. Louis Group. Mostly Limestones.	None known except where broken by an intervening sand in Pike and Martin Counties.	Corresponds to Mountain Lime, Big Lime and Greenbriar Lime.
	Waverly Group. (Includes Keokuk of Western Ky.) Sandstones and Shales in Eastern Kentucky: Calcareous in Western Kentucky.	Big Injun Group. Cloverport Gas Sand. Berea Grit. Stray, Mt. Pisgah, Beaver, Otter, Cooper, Slickford } Of Wayne Co. Amber Oil Sand of Barren Co.	Corresponds to Place of Pocono Slates of West Virginia.
Devonian.	Black Shale.	Meade County Gas Sand.	
	Corniferous Group. Limestones.	Ragland Oil Sand. Irvine Oil Sand. Menefee Gas Sand.	
Silurian.	Niagara Group. Limestones and Shales.	Boyd's Creek Sand of Barren County.	
	Clinton Group. Limestones and Shales.	Clinton of Morgan County.	Top of Great Limestone Series.
(Ordovician.) Lower Silurian.	Hudson Group. Mostly Limestones and Blue Shales, Some Sandstone.	Caney Sand. Upper Sunnybrook Sand. Barren County, Deep Sand. Cumberland Co., Shallow Sand.	
	Trenton Group. Trenton	Trenton Limestones.	Lower Sunnybrook Sand.	Blue Grass Limestone.
	Trenton Group. Black River.			
	Trenton Group. Stones River.	Birdseye. Magnesian.	Barren Co., Wayne Co., Clinton Co. and Cumberland Co., Lower Sands.	Kentucky River. Birdseye and Magnesian.
	Trenton Group. Stones River.	Chazy.		Kentucky River. (Not all above drainage.)
	Knox Dolomite.		Deep Sand of Wayne County.	In Southern Kentucky. (Not above drainage.)
	Calciferous.		Salt Water Sand at Top. Gas Sand in Estill County.	White sandy limestones. (Not above drainage.)

Kentucky Gas and Oil Sands.

Beaver. Wages.
Horton. Jones.
Pike. Epperson.
Salt.

Big Injun. Cloverport gas-sand. Stray. Wayne County.
Berea Grit. Barren Co. amber oil sand. Mt. Pisgah. Wayne County.
Beaver, Otter, Cooper, Slickford. Wayne County.

Black Shale, in Meade County.
Ragland, in Bath, Estill, and Menefee Counties.

Boyd's Creek, in Barren County.

Clinton, in Morgan County.

Caney (upper part of Hudson), in Morgan, Etc.
Upper Sunnybrook (lower part of Hudson), in Wayne, Barren, Etc.

Trenton { Lower Sunnybrook, in Wayne, Etc.
Barren, Cumberland, Clinton and Russell County lower sands.

Deep sand, in Wayne County, at the top of the Calciferous.

Deep gas-sand (Calciferous), in Estill County.

In the Pennsylvania field the section starts at No. VIII—the Devonian, and goes up through No. XV—the Upper Productive Coal Measures, at the base of which is the well-known Pittsburg coal. The principal oil sands, in ascending order, from the Warren and Bradford are:

Mahoning-Dunkard.

Salt sands.

Big Injun Group { Keener. Big Injun. Squaw.

Venango Group { Gantz—First—100 foot (Berea?). 50 foot. 30 foot. Gordon. Fourth. Fifth—McDonald. Sixth—Elizabeth.

Warren and Bradford Groups.

Coming southwest into West Virginia, the Warren and Bradford Groups are not found productive, but other and higher sands come in. The list, as seen from the section, is:

Uniontown.
Morgantown—Little Dunkard.
Mahoning,
Dunkard,
Cow Run.
Second Cow Run,
Freeport gas-sand.
Gas-sand.
Salt sands.
Maxton (Cairo?).
Keener.
Big Injun.
Squaw.
Smith's Ferry.
Berea Grit.
First—Gantz—100-foot.
50-foot.
Second—30-foot.
Stray.
Gordon Stray—Campbell's Run.
Third—Gordon—Flat Run.
Fourth.
Fifth—McDonald.
Sixth—Elizabeth—Bayard.

The Ohio series contain both higher and lower sands, but the Venango group disappears entirely. The list is:

Goose Run.
Mitchell.
First Cow Run.
Macksburg, 500-foot.
Second Cow Run.
Salt.
Maxton.
Big Injun Group { Keener. Big Injun. Squaw.
Berea Grit.
Ohio Shale.
Lower Helderburg.
Clinton.
Trenton.

In the West Virginia field, the deepest sand reached (with the exception of a small area in the northwestern part of the State, where the Corniferous Limestone was reached), was the Sixth or Elizabeth sand. All the Kentucky rocks in the section below the Devonian are there too deep for the drill.

In the Ohio field the thinning out of the measures and the rapid rise in the rocks to the west, enables the drill to penetrate to the Trenton and below, in parts of the State, while higher rocks, i. e., those of the Coal Measures, come in in the eastern part.

Coming now to the Kentucky field, the Warren and Bradford sands have disappeared before reaching West Virginia; the Venango group of sands reaches over into West Virginia, but disappears before reaching Ohio or Kentucky; the Berea Grit, the Big Injun group and the sands of the Conglomerate series extend from West Virginia into both Ohio and Kentucky. Finally, comparing the Ohio and Kentucky fields, it will be seen that nearly all the Ohio sands are found in Kentucky as well, up to the base of the Coal Measures. No sands have been located as yet in Kentucky above the Conglomerate Measures, but, on the other hand, several producing sands have been found in the formations between the Trenton and the Devonian Black Shale in Kentucky, which do not appear as producers in Ohio.

Of the long list of producing sands, from the Warren and Bradford, at the base of the Pennsylvania list, up, all below the Berea Grit have disappeared before reaching Kentucky, the Berea Grit, the Big Injun group and the sands of the Conglomerate Measures being all that are left that are common to all four States. Of the remainder of the Kentucky sands, some, as mentioned above, are in lower rocks and found in Ohio as well, and some seem to be found in Kentucky alone. These will all be discussed in detail farther on.

CHAPTER II.

General Geology of Oil and Gas.

The question of the source or origin of the vast supplies of oil and gas found in the rocks composing the earth's crust is a very interesting one, but one that can not be answered positively as yet. It can be taken for granted that they have a common origin, more or less gas being found in connection with all oil fields, and the chemical composition of the gas from any one field agreeing with that of the oil from the same field; the reverse of this, however, is not true, large gas fields existing which have no connection with oil, the gas being followed directly by salt water, but it is safe to assume in these cases that the process of distillation has simply been carried that much farther.

Numerous more or less ingenious theories have been advanced to account for the origin of oil and gas, and most of them are, apparently, based on reasoning sound enough as far as it goes, but, unfortunately, none of them elastic enough to cover all the facts and conditions demonstrated in the different fields and formations by the actual test of the drill.

Two principal theories have heretofore been advanced—the organic and inorganic—the first accounting for the oil and gas as products of organic matter, either animal or plant or both, and the second ascribing them to chemical reactions on inorganic substances, aided by the action of heat. To these has more lately been added a third theory, which, while still ascribing the origin of oil and gas to organic matter, brings in as the agent which brought about the change, the action on that organic matter of bacteria acting in the absence of air, and citing as proof the production of hydrocarbons by the action of bacteria under water on vegetable matter in marshes, as going on at the present day.

These theories have been discussed in great detail by the late Dr. Orton in a preliminary report, issued by the Kentucky Geological Survey, on petroleum and natural gas in Western

Kentucky,* and in his reports on the geology of Ohio; and, more recently, by Professor Bownocker in a bulletin on oil and gas in Ohio. Reference is made to those reports for a more extended discussion of the different theories.

GEOLOGICAL CONDITIONS NECESSARY FOR THE ACCUMULATION OF OIL AND GAS IN THE ROCKS.

It can easily be demonstrated that the amount of petroleum present in the different formations comprising the geological scale in Kentucky is enormously large. Wells can hardly be drilled anywhere without obtaining shows of oil or gas or both. Rocks hundreds of feet in thickness and covering large areas carry, disseminated through their masses, perceptible percentages of these substances—amounts which in the aggregate are beyond computation, but which, owing to the fact that they are so disseminated, are of no practical value. Under these circumstances, the question as to the conditions necessary for the concentration of these substances in quantities sufficient to make them available, and the further question as to how to recognize these conditions in advance of the drill become of utmost importance.

Three conditions are generally insisted upon by geologists as necessary before these accumulations of oil and gas can occur, and to these can be added a fourth, as important as any,—possibly more important than any.

1. *A porous rock or reservoir to contain the oil and gas.* This, while of importance, is only relatively so. It does not need demonstration to prove that a coarse sandstone or a pebble-rock will carry more oil per cubic foot than a close, fine-grained limestone can carry, but the fact remains that almost any kind of a rock, if not too dense and close-grained, can act as a reservoir, and will, other conditions being favorable, produce amounts of oil or gas surprisingly large. The name "oil-sand," applied to an oil-bearing rock, does not necessarily mean that it is a sandstone. The name was first applied to the oil-producing rocks of the old Pennsylvania fields, which were sandstones, but by common usage it is now applied to any rock

*This report is now out of print. Such parts as are now applicable will be republished in another edition of this Oil and Gas bulletin.—C. J. N.

which carries oil, and may be a sandstone, a dolomitic or magnesian limestone, or a calcareous limestone. Some of the limestones, while apparently very close-grained, produce enormous quantities of oil and gas. The question of porosity, however, still remains an important one in two respects—one, that the amount of oil per cubic foot of rock increases with the porosity, and the other, that in a given field, when the porosity of the rock changes locally, the valuable accumulations of oil and gas will be found where the rock is more open; pools in the same general field, where all other conditions are apparently the same, being separated only by a space where the oil-bearing rock is more dense and closer grained than in other parts of the field.

2. *Cover.* Over all rocks carrying gas or oil in quantities is a more or less impervious cover, the necessity for which can easily be seen, preventing, as it does, the oil from rising into higher strata, and confining it within the limits of the porous rock in which it is found. The cover consists sometimes of a bed of close-grained shales, sometimes of a very dense, extremely hard layer of rock, generally containing more or less lime and alumina, and called the "cap;" sometimes of a bed of clay.

The "cap" of hard, dense rock, varying in thickness from a few inches to several feet, is probably the cover most often found, although a bed of impervious clay shales over an oil sand is not uncommon. In the latter case the oil sand itself will generally be found close and hard at the top. In drilling through a thick sand, it is not unusual to find in records of wells an oil sand reported as carrying oil in the lower part; but it is quite probable that in such cases there is a thin stratum of shale, too thin to be noticed by the driller, or a hard, thin shell above the oil, separating it from the overlying rock, and preventing it from rising higher.

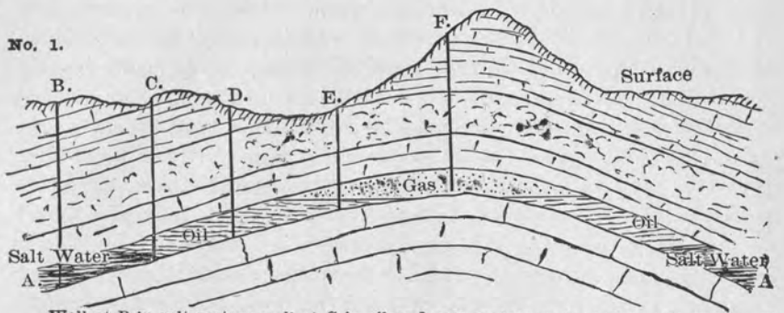
3. *Such structure of the rocks as will arrest the movement of oil and gas and confine the products of large areas within relatively small limits.* The anticlinal theory of the accumulation of oil and gas in folds in the rocks has long been advocated by prominent geologists and has come to be almost universally recognized as the form of structure necessary for valuable accumulations of those substances. The term "anticlinal," however, must be taken in a broad sense, as the theory does not teach that an anticline or complete arch in the rocks must exist

before oil or gas can be accumulated. It is true that, as first noticed in the oil fields of West Virginia and Pennsylvania, the lines of production were mainly along the lines of the numerous anticlines, or arches, found in those fields, but as data have accumulated from these and other fields, and careful measurements and comparisons made over large areas of producing territory, it has been proven that not only anticlines, but other folds in the rocks—monoclines, terraces, etc.—may also be effective in producing an accumulation of oil and gas. In a general sense, and retaining the term "anticlinal," given a porous rock containing oil and gas and dipping at any angle, some sort of a fold or change in the dip, which will tend to prevent the rise of the oil and gas up the dip and cause it to accumulate at that point, is necessary; and, given such a fold with the other conditions present, an accumulation of oil and gas may confidently be expected

It is claimed, as proof of the anticlinal theory, that all known oil and gas fields, where the necessary measurements of the dips of the rocks could be obtained, have proven to be intimately connected with lines of structure—folds or changes in the dips of the rocks of some kind—and that even such fields as have not as yet been so proven, probably would be, if all the data could be obtained. The theory has also been put to further proof by the location of oil and gas wells in advance of the drill. Some of the best known oil and gas fields in other States were located in this way; while, what is equally important, non-producing territory was pointed out either by the absence of these structural lines or the existence of synclines.

Structural folds in the rocks may be of many different forms to be effective in the accumulation of oil and gas, the theory simply requiring enough change to enable the different materials to arrange themselves in the order of their specific gravity, the gas highest, the oil next, and the salt water lowest. To make this clearer, sketches are given below to show some few of the most common forms. It is a very common idea among those who have not had the opportunity to familiarize themselves with the theory of anticlinal accumulation, that an anticline will show not only as an arch in the rocks, but also as an elevation on the surface; as a matter of fact the surface may be of any shape whatever, the anticline or other fold running across and under valleys and hills alike.

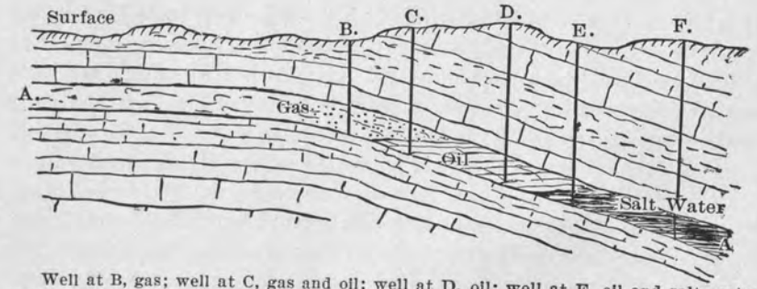
No. 1.



Well at B in salt water; well at C in oil and salt water; well at D in oil; well at E in oil and gas; A—A, Oil Sand.

No. 1 shows an ideal form of anticline, with a possible development of salt water and oil on each side of the axis, and gas at the summit of the fold.

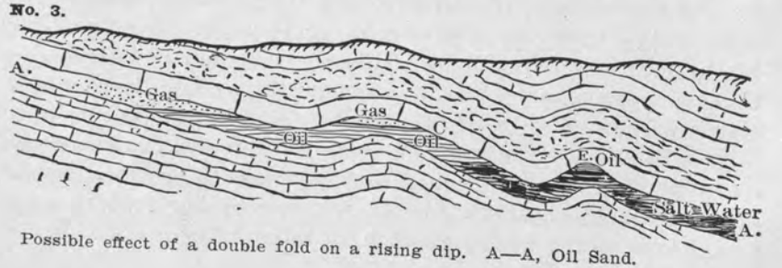
No. 2.



Well at B, gas; well at C, gas and oil; well at D, oil; well at E, oil and salt water; well at F, salt water; A—A, Oil Sand.

No. 2 shows a monocline, with gas at the top and oil and salt water in succession, lower down the dip. Both of these sketches

No. 3.



Possible effect of a double fold on a rising dip. A—A, Oil Sand.

show a possible development of both oil and gas; as a matter of fact, the latter would more likely be found at points along the axis where the elevation of the axis may produce domes.

No. 3 shows a possible application of the anticlinal theory where the oil and gas are caught in small folds not near the top of the dip, and also shows how two "pools" of oil (at *C* and *E*), and two gas pools, may exist close together in the same field.

These sketches are simply intended to show, in a very general way, the manner in which the gas, oil and salt water arrange themselves in the order of their specific gravity, and the futility of expecting to get oil or gas in a syncline where nothing but salt water could be expected.

In Kentucky but little regard has been paid, so far, to this point of structure, and large amounts of money have been expended in drilling where there was no chance for an accumulation of oil because of a lack of anything like a fold in the rocks, while there is already nearly enough data on hand to demonstrate that all the fields which are now producing are intimately connected with folds of some sort. The gas field in Meade county, from which gas is piped to Louisville, is on a small dome interrupting the westerly dip of the black shale; the Cloverport gas wells are on a series of small arches or anticlines. Both of these fields have been long-lived, when the small size of the folds on which they are situated is considered, and both give nothing but salt water outside of the folds. The Warfield gas well, which produced gas in enormous quantities, is directly on the summit of a sharp anticline. The Ragland field, in Bath county, is near the axis of a monoclinal fold, with the production limited to a comparatively narrow belt parallel to the axis; and the Estill county and Wolfe county fields show about the same conditions. The productive areas in Wayne county and Cumberland county are limited, so far as they have been examined, to small anticlines and domes, while in the Knox county fields the best wells can be followed on very narrow lines produced by sharp changes in the dips of the rocks.

It is hoped that as the work of the Survey is extended, the study of dips and structure in the different oil fields of the State, which is outside the present scope of this bulletin, may

be taken up in detail and, with the co-operation of the operators, be worked out in detail for each particular field.

4. *Salt water.* The fourth, and what is probably the most important of all the conditions for the accumulation of oil and gas, is the presence of salt water in the same rock in which the oil and gas are found. The discovery of oil and gas by drilling for salt water, is a matter of history; that in all oil or gas fields, salt water is found somewhere in the same rock as the oil and gas, and conversely, that in any porous rock containing salt water, oil or gas will be found in some amount higher in the rock, has been proven in the development of the oil fields of the world. The influence of reservoir, cover and structure on the accumulation of oil and gas, have already been shown, but the presence of salt water in the same rock is paramount to all these; a rock may carry oil disseminated throughout its mass, it may be porous and at places have the proper structural fold for the accumulation of oil, but without the presence of salt water the accumulation in quantities will not take place. In some fields fresh water may be found below the oil, but in these cases, salt water will be found further down the dip, and the theory holds good. The salt water is the direct agent through which the accumulation of oil and gas has taken place. With a given rock containing oil scattered throughout its mass, the salt water in the same rock, rising up the dip, collects the oil as it rises, the latter by its lighter gravity then separating from the water and rising ahead of it, in volume increasing in proportion to the distance along the dip through which it rises, finally being caught and held in some structural fold in the rock; but (and this is an important modification of the anticlinal theory) only rising far enough up the dip to keep ahead of the salt water, so that the position of the oil with reference to the summit of the fold, may be predetermined by the height to which the salt water can rise.

STRIKE LINES.

The line of strike of an anticlinal, or other fold, is a line parallel to its axis and at right angles to the direction of the dip of the rocks down the fold, and it is along these strike lines, after the width of the field up and down the dip has been determined, that the extension of the field must be looked for. This fact accounts for the widely prevailing notion that oil and gas fields are all on a 45-degree line northeast and southwest. The anticlines on which the older oil fields were found, were smaller waves running in a generally parallel direction to the Alleghany mountain system, which runs approximately northeast and southwest, and in these fields a 45-degree line would therefore often run through considerable oil territory. There is no fixed law, however, in regard to direction of structural lines in the rocks. They may run in any direction, and the only safe rule in locating extensions is to follow the strike lines, or lines parallel to the axes of the folds.

ROCK PRESSURE.

The tension or pressure exerted by the gas in a well is known as the rock-pressure, and varies considerably at different depths and in different fields. When the well is closed in, the pressure in the casing will, of course, sooner or later equal the pressure in the well, and the rapidity with which the pressure increases after being closed in, is proportional to the volume of gas which the well will produce, a well gaining 100 pounds per minute after being closed, having a much larger production than one gaining only ten pounds per minute, although the final rock-pressure may be the same in both. The rock-pressure, then, is the total pressure per square inch attained in the well after being closed in, and while, in the same field, a small well will, after closing in, be longer in attaining this pressure than a well of larger volume would, the final pressure will be approximately the same all over the field.

The minute pressure is the pressure per square inch reached in one minute after being shut in, and, as stated above, the greater the volume produced by the well, the greater the pressure reached in a minute. From the minute pressure and the rock-pressure, the volume discharged can be roughly estimated.

The open pressure is the pressure exerted by the gas in open flow from the casing, and the amount of pressure depends on the volume of gas produced and the size of the casing, increasing the diameter of the casing diminishing the open pressure. The open pressure is always very much smaller than the rock-

pressure; a well having a rock-pressure of 500 pounds may have an open pressure of less than one pound, the open pressure being entirely unconnected with the rock-pressure and, with a given size of casing, depending on the volume of gas discharged. A well with a very high rock-pressure and a very low open pressure will, after being closed, increase in pressure very slowly, the volume discharged being small.

OIL POOLS AND LIMIT OF SUPPLY.

The name "pool" is quite commonly applied to the productive area of an oil field, and many persons use the name in its literal meaning, their conception of the storage of oil in the rocks being the same as a pool of water on the surface, many even believing that these "pools" are, in some cases, fed by veins or running streams of oil. The oil-pool is simply that portion of the oil rock which is stored with enough oil to give an available supply, either by natural flow or by pumping, and the oil is stored in the pores of the rock just as water is stored and held in the pores of a sponge.

It is not at all likely that the production of oil is still going on; the products have practically all been stored, and when tapped by the drill their final extinction is only a matter of more or less time, depending on the thickness and porosity of the sand, the extent of the field, and the rapidity with which wells are drilled and pumped.

The writer has often heard the belief expressed that oil can be found anywhere by going "deep enough." It is hoped that the perusal of these pages will not only dispel that idea, but be of assistance to the prospective driller in determining, approximately at least, how deep it will be necessary to go to reach the sands he may want to test, and to show what sands he may expect to find beneath the surface in different parts of the State.

CHAPTER III.

The Principal Divisions of the Geological Scale in Kentucky and the Oil Sands Corresponding to Each.

CONGLOMERATE MEASURES.

In the Conglomerate Measures are here included, not alone the massive sandstone, sometimes carrying no pebbles, and sometimes a true conglomerate filled with water-worn pebbles, known all over Eastern Kentucky as the Conglomerate Sandstone, but all the shales and sandstones, with occasional included beds of coal, extending from the top of the Chester Group to the base of the heavy shales which mark the beginning of the lower productive Coal Measures. Thin in Northeastern Kentucky, and consisting there mainly of a heavy sandstone underlaid by a bed of dark shale, the latter often carrying a bed of coal, it thickens rapidly to the south, southeast and southwest, and, as fully developed in Southeastern Kentucky, consists of a series of heavy, massive sandstones, separated by beds of shale and slate, and carrying several seams of coal, and reaching a total thickness, at its maximum, of over 1,000 feet. It forms the most marked features of the topography in its outcrop along the western edge of the eastern coal-field, making the massive sandstone cliffs which everywhere overlie the Chester and St. Louis limestones, and again, where brought up by the Pine Mountain fault, forming the heavy sandstone ledges which cap that mountain.

Beginning on the Ohio river, in Greenup county, its thickness is given by Professor Crandall as 30 to 100 feet in Greenup and Carter counties, 90 feet at Grayson, 158 feet on the North Fork of Licking river, and about 300 feet in Jackson and Menefee counties. It is thicker, under cover, in Wolfe and Morgan counties, the record, given further on, of a well on Caney creek, in Morgan county, giving its character there in detail. East and south of Morgan county it thickens much more rapidly,

and, going towards the Big Sandy river to the east and Pine mountain to the south, is divided into a number of sandstone ledges, with heavy beds of shale between, with a total thickness, as mentioned above, of from 600 to 1,000 feet. The main ledge of the Conglomerate, in the counties where it has not yet divided up, has produced more or less oil, gas and salt water where drilled through. In Boyd county it gave salt water. In Morgan county it proved the source of a very persistent flow of gas, and in Breathitt, a well drilled into it on the waters of Frozen creek, gave a considerable flow of black oil. It was also the source of the shallow black oil of Johnson county. Its production, however, has not proven, as yet, of any special importance in the area under which it exists mainly as a single heavy ledge of sandstone. In those counties, however, where it has thickened and divided up into several heavy ledges, with corresponding shales between, the record becomes entirely different. In Floyd, Knott, Martin and Pike counties, where some extensive drilling has been done, the Conglomerate series form the main part of the formations, from near the surface down to from 1,000 to 1,300 feet, and in that distance four well-defined sands, carrying gas, oil and salt water in quantities, have been developed. In Knox and Whitley counties the record is about the same, most of the wells starting approximately at the top of the Conglomerate series, the latter having a thickness of 800 to 900 feet, with from three to four producing sands, and all the production of the field, as in the Floyd county district, coming from the Conglomerate, with the one exception, common to both fields, of deeper drilling getting additional production from the Big Injun sand. There still remains a large area in Southeastern Kentucky underlaid by the thickened Conglomerate series, which has not been tested by the drill, and other areas where but little drilling has been done, where the chances for oil and gas would seem to be at least worthy of a trial. Under the headings of the above-mentioned counties, respectively, will be given later on a number of records of drilled wells, which will show the producing sands and the full thickness of the Conglomerate series as there developed. By reference to Map No. 1, accompanying this report, it will be seen that, outside of the counties of Knox, Floyd, Johnson and Martin, this whole area is, as yet, practically untested.

In Western Kentucky the Conglomerate still shows in outcrop around the western coal-field, but it is thinner and quite variable in character and thickness, and its qualifications as an oil or gas sand are, as yet, almost entirely unknown. It is a noteworthy fact, however, that some of the most important occurrences of "asphalt rock" are in the Conglomerate.

CHESTER (MAUCH CHUNK) GROUP.

This is represented by a series of sands, limestones and soft red and green shales, lying between the St. Louis limestone group and the Conglomerate Measures. From the Ohio river these outcrop southwesterly along the western border of the Eastern Coal-field, but, for some distance to the southwest from the river, they are very thin, showing sometimes as a few feet of red and green shales and sometimes wanting entirely. They increase in thickness to the southwest and around the Central Bluegrass region, in a manner similar to the thickening of the St. Louis in the same direction. In Jackson county they are reported as showing fifteen to thirty feet of red and green shales with bands of intercalated limestone. In Whitley county the total thickness has increased to ninety feet, as shown in the well at Pine Knot. In Clinton county Dr. Loughridge gives a thickness of 228 feet, as follows:

Shale, or green marl and limestone	130
Dark, impure limestone	73
Greenish sandstone	25
	228

Farther west they thicken still more, and in the western part of the State reach a thickness of from 600 to 800 feet. A record of a well drilled at Tell City, just below Hawesville, shows a thickness there of 597 feet.

In West Virginia and Pennsylvania the corresponding formation has been given the name of Mauch Chunk red shales, and Professor White, in his West Virginia report, gives it an average thickness of 150 feet. In Knox county, deep well records show the Chester series of shales and limestones as about 200 feet thick. It will be seen from this that they thicken from their outcrop in Northeastern Kentucky to the southeast, as

well as to the southwest, as do the St. Louis limestones. In Eastern and Southeastern Kentucky, the records of drilled wells show considerable unconformity between the Chester, or Mauch Chunk, and the underlying St. Louis, or Mountain limestone, and also between the St. Louis and the underlying Big Injun group. All three sometimes show in place, and again one or two, out of the three, will be considerably cut down, and sometimes two will show in one well, while in another well, only a short distance away, one of them will be entirely wanting. This peculiarity will be shown in records of wells to be given farther on.

So far as known, no oil or gas sands have been, as yet, discovered in the Chester rocks, with the exception of a gas flow from a Chester sand in a well in Martin county. Professor White reports them as barren in West Virginia, and well records in Eastern Kentucky, with the above exception, show nothing; but in Western Kentucky (where the formation has developed to a series of limestones, shales and sandstones, 600 to 800 feet thick) some of the massive sandstones in this group are, on their outcrop, saturated with oil, which has oxidized and made the well-known Kentucky asphalt rock. Not much drilling has been done there where these rocks are under cover and it may be that they will yet furnish a supply of oil. There are three or four massive sandstones in the series there which would make suitable reservoirs. Plate No. 2, showing the arch of the Rough Creek anticline at a point about a mile south of Leitchfield, Grayson county, also shows a quarry in one of these Chester sandstones—the No. 2 sandstone of the survey reports.

ST. LOUIS LIMESTONE GROUP.

The division of the Sub-carboniferous known as the St. Louis limestone group, and also known as the Newman limestone, the Mountain Lime, and the "Big Lime" of the driller, together with the overlying Chester shales and limestones, forms the division between the sands and shales of the overlying Conglomerate and Coal Measures and the underlying Waverly group. It is nearly always to be found in place, though of varying thickness, and constitutes a valuable guide to the driller; but being thinner and lying so much nearer the surface in

No. 2. Arch of the Rough Creek Anticline in quarry south of Leitchfield, Grayson County.

parts of this State than it does in West Virginia and Pennsylvania, many drillers have been mistaken in its identity. Accustomed to striking it deep down in the wells after going through a long list of shales and sands, they have, in Kentucky, erroneously applied the name "Big Lime" to the long series of limestones which begin below the Devonian Black Shale and extend downward to an unknown depth, thus taking these limestones to be the same as the "Big Lime" of West Virginia and Pennsylvania, when really they belong much lower in the section. To any one unaccustomed to the Kentucky section, this is a very natural mistake, but one causing much confusion.

Beginning at the Ohio river, near Portsmouth, the St. Louis limestones have thinned down to almost nothing; they are reported missing in the wells at Portsmouth and Ironton, but from there on to the southeast and southwest they thicken rapidly. Passing around and to the south of the Central Bluegrass region, they thicken still more rapidly, reaching a thickness of eight hundred feet and possibly more, in the western part of the State, and forming the surface rocks over large areas. In the well near Ashland, the St. Louis is sixty feet thick; in a well near Huntington, 150 feet thick, and farther up the Ohio river, in a well opposite Gallipolis, 165 feet thick. Crandall gives it a thickness of from 0 to 40 feet on outcrop in Greenup county, 35 feet at Soldier, 75 feet at Olive Hill, 90 feet at Boone Furnace, 140 feet at Carter Caves, 20 to 30 feet in Rowan county, and 40 to 60 feet in Menefee. Linney gives its outcrop at 65 and 100 feet in Bath and Montgomery. Owen gives outcrops in Powell and Estill counties of about 160 feet, and Sullivan gives it as 225 feet in Jackson and Rockcastle. Well records give a thickness of 20 feet near Grayson, 90 at Denton and 109 at Strait Creek in Carter county, 75 to 110 feet in Wolfe and Morgan, 210 feet in Magoffin, an average of 150 in Lawrence, 138 to 210 in Floyd, about 200 in Martin and 180 to 240 in Pike. In the Pike and Martin fields, though, it seems from the records to be very irregular in its appearance, sometimes showing its full thickness, sometimes separated in two parts by a ledge of sandstone, and again being very much broken and mixed up with the overlying Mauch Chunk, or Chester series, and the underlying Big Injun group. On the Pine

mountain outcrop, Professor Crandall reports it as 500 feet thick, but this probably includes the overlying Chester rocks. Professor C. J. Norwood gives it as about 400 feet thick on the Cumberland mountain outcrop at Cumberland Gap. Going west, a well at Pine Knot, in Whitley county, gives 395 feet, and Loughridge gives 303 feet on outcrop in Clinton county. In the eastern part of Meade county it is 475 feet thick, in Hart over 500 feet, in Breckenridge over 700 feet, and it thickens from that to 800 feet, and probably more, in the extreme western part of the State. Under cover, in Eastern and Southeastern Kentucky, well records give the following depths from the surface to the top of the St. Louis:

	Ft.	
Carter County (Grayson)	80	
Boyd County	500	
Huntington, W. Va.	970	
Lawrence County	157 to 1,025	(Due to an anticline)
Wolfe County	420	
Morgan County	360 to 460	
Magoffin County	715	
Floyd County	1,150	
Martin County	1,250	
Pike County	1,500	
Whitley County (Pine Knot)	900	

These depths, of course, will vary somewhat, but they are about the average, and will, when combined with the thickness given for the St. Louis on preceding pages, serve as a close guide for drilling.

The St. Louis limestones are petroliferous in a number of places, giving a strong smell of petroleum when broken with a hammer, and often showing small cavities filled with oil, but have furnished no supplies of oil or gas, unless the gas from a portion of the Pike and Martin county field can be referred to this formation instead of the Big Injun group. The two formations, as mentioned on a preceding page, show considerable unconformity in this field; the Mountain Lime will be present in full thickness, with the Big Injun under it, and in another well close by be almost or entirely gone. The heavy flow of gas which is found in this section, Professor White, in his West Virginia report, attributes entirely to the Big Injun, claiming the latter to be changed to part lime and the gas to be obtained from streaks of sand contained in it, a conclusion

hardly justified by the records from the wells. The log of the old gas well at Warfield, in Martin county, shows the formations nearly all Conglomerate, with 200 feet of white and blue shales under the Conglomerate and 100 feet of sandstone and "shells" under that, and then a heavy flow of gas from seven feet of sandy limestone. The log of this well does not agree with any other records obtained, the 200 feet of light shales seeming to be a local feature. In the Burning Springs well, located just across the river from Warfield, the Mauch Chunk or Chester series show very plainly at from 819 to 1,038 feet; then comes 162 feet of Mountain Lime, from 1038 to 1200, with gas in the limestone (nearer the top than the bottom) at 1098; then 138 feet of shelly slate, with gas in a sand "shell" near the top, and again at 1315, near the bottom. This 138 feet of shelly slate represents the Big Injun group, with gas, and the 162 feet of limestone above it is the Mountain Limestone, also producing gas.

Other wells in Floyd, Lawrence, Pike and Martin counties show a dividing ledge of sandstone, contained in the Mountain Lime, from which large flows of gas are obtained, with some shows of oil. A number of other wells undoubtedly give gas from the Big Injun alone, and one or two from both Mountain Lime and Big Injun, so that it seems certain that while a large part of the gas is produced by the Big Injun, the Mountain Limestone is in this immediate section a gas producer also, the gas coming from the ledge of sand mentioned above as included in the limestone.

WAVERLY GROUP.

The Kentucky Geological Survey applied the name Waverly to the group including all the formations between the top of the Devonian Black Shale and the base of the St. Louis Limestones. The name was unfortunately chosen, but it has become so well known, as applied to those rocks, that it will, until replaced by a better one, continue to be used here. It includes the Knobstone series and shales of Eastern Kentucky, described by Dr. Owen, and corresponds in position to the Waverly group of the Ohio scale, and the Pocono of West Virginia. In Eastern Kentucky it consists generally of a series of sandstones, shales and shaly sands, easily drilled through, and includes

within its limits the Big Injun sand, another heavy sand below the top of the Waverly, which may take the place of the Big Injun (see heading "Big Injun Sand"), and the well-known Berea Grit of the Ohio oil-fields. In Southern Kentucky it begins to change in character, becoming more calcareous, especially near the top, where the Keokuk Limestones come in, and includes the Stray, Mt. Pisgah, Beaver, Cooper and Slickford sands of Wayne county. In Western Kentucky, where the Keokuk thickens up, it becomes still more calcareous, consisting mainly of limestones and limy shales, with a heavy bed of clay shales at the bottom, and includes the Keokuk shales and limestones. The Cloverport gas sand of Breckenridge county, the gas-bearing sands of Warren county, and the amber oil of Barren county are found in the Keokuk division.

The Waverly group covers considerable area in outcrop, and is under cover in still larger areas. These rocks form the surface rocks of a section extending around Central Kentucky, from the Ohio river in Lewis county to the Ohio river again in Bullitt county, and from Boyle and Lincoln counties southwest to the Tennessee line. From these lines of outcrop they dip rapidly to the southwest and southeast under the Western and Eastern coal-fields respectively.

In thickness the Waverly averages roughly about 400 feet, although thicker than that under cover in Eastern Kentucky, where it will average about 600 feet. The average thickness on outcrop is as follows:

Greenup County	500	feet
Bath County	400	"
Fleming County	400	"
Garrard County	300	"
Clinton County	380	"

Thinning to the southeast, its outcrop, where brought up by the Pine Mountain uplift, is only about 200 feet in thickness. In Western Kentucky the records of the Meade and Barren county wells give a thickness there of about 250 feet to this group, the section showing very calcareous at the top, and with a thick bed of shales at the bottom. Farther west, under cover, the section has changed materially, records in Warren showing a thickness of nearly 400 feet, and in Breckenridge and Hart a thickness of over 400 feet, the section consisting mostly

of very dark and black limestones and lime shales, the limestones, many of them, being argillaceous. Still further west no records are available to give the character or thickness of these beds. A record from Caldwell county, given later on, shows black hard limestones about where they would be due, but the lines of division can not be drawn on the record.

DEVONIAN BLACK SHALE.

The Black Shale constitutes a well-known landmark to nearly every driller, its soft drilling and black color making it easily recognized. Crossing the Ohio river from Ohio into Lewis county, it follows in outcrop an irregular line clear around the Central Bluegrass region to the Ohio river again in Jefferson county, where it crosses over into Indiana. Another line of outcrop begins on the Cumberland river on Forbush and White Oak creeks, in Wayne county, and extends down the river and above water level on both sides to the Tennessee line. In thickness the Black Shale varies considerably, but in a general way it thins out to the southwest and thickens very rapidly to the east. The following are its average thicknesses at various points on its outcrop.

	Feet.
Lewis County	225
Fleming County	200
Bath County	135
Montgomery County	110
Clark County	100
Estill County	100
Powell County	100
Pine Mountain	150
Garrard County	50
Marion County	60
Nelson County	50
Larue County	65
Bullitt County	70
Jefferson County	100
Casey County	45
Russell County	40
Clinton County	30
Cumberland County	25
Monroe County	20

Well records give it the following thicknesses under cover:

	Feet.
Magoffin County	400
Morgan County	285
Wolfe County	191
Menefee County	150
Rockcastle County	150
Whitley County	40
Wayne County	35
Barren County	35
Warren County	90
Breckenridge County	95
Hart County	105

Its remarkable thickening to the east can best be shown by a line of wells through Ohio and Kentucky, from Lewis county, Kentucky, to Wellsville, Ohio:

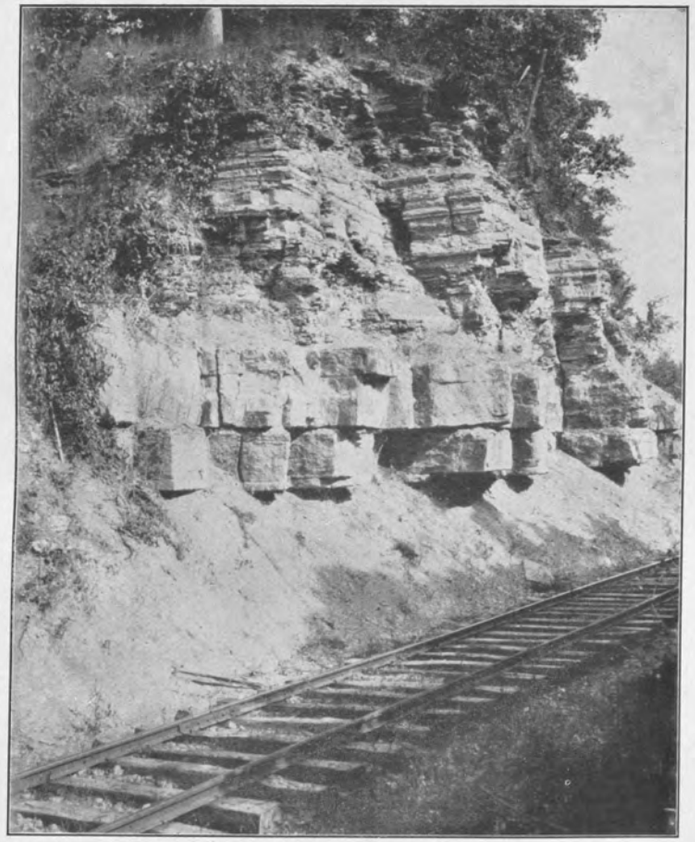
	Thickness.	
In Lewis County, Ky.	225	
" Carter County, Ky.	450	
At Portsmouth, Ohio	560	
" Ironton, Ohio	680	
In Lawrence County, Ky.	644	
Ohio River, near Gallipolis	1,000	nearly
Ohio River, near Wellsville	3,000	"

In all these counties, in Kentucky as well as in Ohio, where this thickening occurs, there are several divisions in this shale and the shales are often of different colors—black, white, brown, etc.—the other Devonian shales of Ohio and West Virginia being added to the black Ohio Shale of the Kentucky outcrop.

This thickening of the Devonian shales, combined with the thickening of the St. Louis and the Conglomerate measures, would make very deep drilling necessary to reach the lower rocks in parts of Eastern Kentucky.

THE DEVONIAN (CORNIFEROUS) LIMESTONES.

The Devonian limestones in Kentucky do not attain much thickness, ranging from only a trace in places up to 35 or 40 feet, but they are important economically as furnishing the producing rock for two well-developed oil fields and a gas field of much promise, with a possibility of a greater development in the future in other localities. In outcrop they follow on the



No. 3. Devonian Shale, Corniferous Limestone and Niagara (Osgood) Shale. L. & E. R. R. East of Virden, Powell County.

map the outcrop of the Devonian Black Shale (which directly overlies these limestones) from the Ohio river in Lewis county around to the Ohio river again at Louisville, at which place they form the falls in the river. At Louisville the Devonian limestones probably have their greatest development in Kentucky. They are there divided by Professor Foerste in two parts, the lower corresponding to the Corniferous, and the upper to a higher formation, possibly the Hamilton. The upper part does not extend far into Kentucky, but the lower, or Corniferous, as stated above, follows the outcrop of the Black Shale clear around to the Ohio river again. The Corniferous is often marked, in the upper ledges, by irregular masses of hornstone or flint, which give the rock a peculiar rugged appearance, the softer portion of the rock weathering out and leaving the flint masses projecting. The average section of the Corniferous in Eastern Kentucky on outcrop shows, directly under the Black Shale, a few feet of hard, dark, bituminous limestones, in thin ledges and separated by thin layers of dark, limy shale; under these, one or more massive ledges of gray limestone with flint, and under those several ledges of gray magnesian limestones with no flint, and a heavy bottom ledge of white limestone. The whole will average about twenty feet in thickness in Eastern Kentucky and is underlaid always by the Niagara (Osgood) Shale. The soft Niagara Shale below and Black Shale above, weather much more rapidly than the Corniferous, and leave the latter, wherever outcropping, showing as a bluff projecting beyond the underlying Niagara. Plate No. 3, taken at the cut on the L. & E. Railroad, just east of Virden, Powell county, shows the Corniferous Limestone overlaid by the Black Shale and, in turn, overlying the Niagara Shale. The latter has weathered out and left the Corniferous projecting beyond it in a vertical bluff. It is possible, and in fact probable, that some of the lower ledges of this section do not belong to the Devonian—probably representing the Niagara Limestone and the Lower Helderburg or Water Lime of the Ohio section, but the whole group is so thin, the name Corniferous will still be used to cover it all, at least until a separation can be made.

The Corniferous can not be recognized in any of the wells in Southeastern Kentucky south of Morgan county. It does

not appear in the Whitley county wells, the section there, between the Black Shale and the Hudson, being taken up by the Niagara and Clinton shales, and it is wanting under the outcrop of the Black Shale on Cumberland and Green rivers, so that its southern limit in Central Kentucky can roughly be taken as an east and west line through the extreme southern edge of Lincoln county.* In Eastern Kentucky it shows in well records as far as Magoffin county; beyond that the wells do not go deep enough to reach it. A deep well near Huntington, W. Va., stopped in the Corniferous at 2,770 feet.

At the crossing of the Ohio river just below Vanceburg, in Lewis county, about 50 feet of magnesian limestones show, between the top of the Niagara Shale and the base of the Black Shale. The principal part of this is probably Niagara and Lower Helderburg or Water Lime, but waste of the Corniferous flint is found at the top. This 50 feet rapidly thins out to the southwest, the line of outcrop from the C. & O. Railroad, in Bath county, northeast through Bath and Fleming, showing only occasional outcrops of the Corniferous and, in other places, only a red clay, with waste of the Corniferous, at the base of the Black Shale and in the place of the Corniferous. South of the C. & O. Railroad, however, the Corniferous is in place, showing in outcrop in Bath, Montgomery, Clark, Madison, Garrard and Rockcastle, and up the Kentucky and Red rivers and their branches. On Red river it runs under drainage at Clay City, and on Kentucky river at Irvine. Below drainage, its position is well shown in numerous well records given later on.

A marked feature of the Corniferous group as an oil sand is the fact that, both on outcrop and under cover, it carries the oil sometimes in the hard, flint layers at the top and again in the lower magnesian layers. On the outcrop in Clark county, oil will run from the bottom ledge when broken with a hammer, while in Powell county, just a few miles east, the reverse is true.

In Western Kentucky there is a large area west of a line from Louisville to the Tennessee line, under which the Devonian limestone may be, and probably is, present, but probably very thin. In all this area there is no outcrop of rocks below the

*See map No. 3 accompanying this report.

Black Shale, and in the well records it is impossible to separate the Devonian limestone from other limestones just beneath it; but it outcrops again in Western Tennessee, and is, therefore, probably present, to some extent at least, under this area also. Some of the wells in Barren county give an oil horizon in a limestone directly under the Black Shale, which is probably the Devonian limestone.

THE NIAGARA.

The principal development of the Niagara series in Kentucky is as a bed of soft, light-colored shales, with very thin sheets of limestone intercalated through its mass, and lying below the Corniferous Limestone and above the Clinton group. In Eastern Kentucky this shale ranges from about fifteen to twenty feet, in Garrard and Clark counties, to a hundred and over in Bath and the counties to the northeast. Its greatest thickness seems to be in Bath, Madison, Fleming, Rowan, Powell, Estill, Menefee, Mason and Lewis counties. To the east of these the shale bed thins down very rapidly and is replaced by the Niagara limestones before reaching the Big Sandy river. It outcrops, in varying thickness, from the Ohio river in Lewis county around the rim of the Bluegrass to the Ohio river again in Jefferson county, and is recognized in the wells of Carter, Bath, Menefee, Rowan, Powell, Wolfe, Morgan, Estill, Rockcastle and Whitley counties. On the lower Cumberland river outcrop it is either wanting or very thin.

In Jefferson county, Professor Foerste divides the Niagara into four parts—the Louisville limestone, the Waldron shale, the Laurel limestone and the Osgood shale, the first at the top, and the last at the bottom. Under cover, west and south from Louisville, its total extent is unknown, but the records of wells show the two upper members of the Louisville section as probably cut out. The Niagara shale of Eastern Kentucky is the lowest member, or Osgood shale.*

*This is the shale which is usually (though not always) referred to by the late William Linney as the Crab Orchard Shale, in his reports on certain of the central counties of the State. For a more detailed discussion of the Niagara Shales, see the forthcoming report of Prof. Foerste on the Clays of the Silurian in Kentucky.—C. J. N.

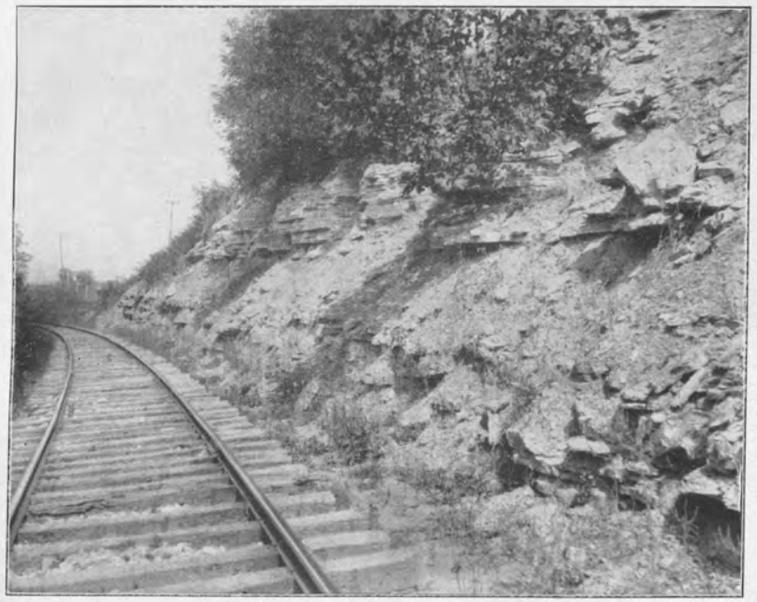
The Niagara furnishes no oil horizons, with one possible exception, one of the oil-bearing rocks in Barren county—the Boyd's Creek sand—being probably referable to the Laurel limestone of the Niagara section at Louisville.

THE CLINTON GROUP.

The Clinton group lies between the top of the Lower Silurian rocks and the base of the Niagara, and outcrops on both the eastern and western edges of the central Lower Silurian area. In Eastern Kentucky it consists of a series of limestones (more or less magnesian and with some of the layers carrying chert), soft, light-colored shales and the well-known red Clinton iron ore, though the latter is not always present. Linney gives thickness of the whole group as averaging from 35 to 50 feet in the counties on the eastern edge. Plate No. 4, taken on the L. & E. Railroad, west of Indian Fields, Clark county, shows nearly all of the thickness of the Clinton Group. The lower and upper ledges shown are magnesian limestones, separated by a bed of soft, blue shale. On the western outcrop it is thinner and changed in character and can with difficulty be recognized in the well records, although undoubtedly present under a large area. Along the Cumberland river outcrop of the rocks under the Black Shale, the Clinton does not appear west of Wayne county. In Eastern Kentucky it falls rapidly with the prevailing dips to the east and southeast, probably reaching a depth of 2,000 feet at the Big Sandy river, and too deep to be reached in the southeastern counties. Its position is well shown in the records of wells given farther on. Under cover the Clinton changes in character, the shales disappearing and the formation showing mostly as gray and dove-colored magnesian and sandy limestones in Eastern Kentucky, and blue or light-colored limestone in Western Kentucky.*

The Clinton appears more or less petroliferous almost everywhere that it is drilled through, and no formation in the Kentucky fields has been more sought for; but so far very little can be credited to it as a producer. Wells in Morgan county are producing a high grade oil from a siliceous limestone in the Clinton, and the oil horizon of the Wolfe county wells is, somewhat doubtfully, ascribed to it, but outside of those fields there is, as yet, not much to be said in its favor.

*The increased thickness of the Clinton Group in East Tennessee extends northward part of the way into Kentucky and is shown in the deep well records of Knox, Whitley and the southern edge of Wayne county.



No. 4. Clinton on L. & E. Railroad, North of Indian Fields, Clark County.

THE HUDSON GROUP.

In the Hudson group (the Nashville group of Tennessee) were included by Linney the series of rocks, mostly limestones and shales, with occasionally a sandstone or sandy limestone, beginning at the top of the Trenton and extending up to the base of the Upper Silurian rocks, or to the base of the Niagara group when the lower members of the Upper Silurian are absent, and, in places where all the Upper Silurian rocks are gone, as along the lower Cumberland river, extending up to the base of the Black Shale. In the central parts of Kentucky, where this group has its greatest development, Linney divided it in three parts—Upper, Middle and Lower—and ascribed to the whole group a thickness of 650 feet. Along the Cumberland river the Hudson again outcrops, but its full thickness is not shown above drainage until after it gets across the Tennessee line, where it corresponds with the Nashville group of Tennessee, and, according to Safford, has a thickness of about 450 feet. This thickness agrees fairly well with what it would be along the Cumberland river in Kentucky, where the upper part of the Hudson is gone, and the whole section, from the top of the Trenton rocks to the base of the Black Shale, including the Cumberland Sandstone, is composed of the rocks of this group, with a thickness probably not exceeding about 450 feet.

In Southern and Western Kentucky, where these rocks have gone below drainage, not much is known of their character or thickness, the line between the base of the Hudson and the top of the Trenton being very difficult to draw on such records as are available. In the northern part of Pulaski, the group has an average thickness of about 525 feet, in Whitley about 650, in Wayne about 550, and in Clinton and Cumberland about 450. In the counties to the north and west of its Cumberland river outcrop, it is present in its full thickness again, Barren, Warren and a portion of Russell giving a thickness of from 650 to 700 feet for this group. In the remaining portions of Western Kentucky there are as yet no records available, and the character of this group is therefore practically unknown. Under the Western Coal-fields, very deep drilling would be necessary to reach it, except possibly at places along the axis of the Rough creek anticlinal.

The Hudson is the source of some very persistent oil horizons, as, for instance, the Caney sand of Wolfe, Morgan, etc., and the upper Sunnybrook of the Wayne district. The shallow wells drilled a number of years back in Bourbon county, near Plum Lick and Middletown, which produced some quantities of heavy lubricating oil, are ascribed to the lower part of the Hudson, and numerous wells which have been drilled into and through these rocks at various places have given shows of oil and gas, as in Clinton and Barren counties and the shallow sands of Cumberland county.

TRENTON GROUP—TRENTON, BIRDSEYE, CHAZY, KNOX DOLOMITE.

In the Trenton group are here included all the rocks (mostly limestones) exposed in Kentucky from the top of the Trenton limestones proper, near Lexington, down through these Trenton limestones, the Birdseye limestones and the Chazy limestones exposed on the Kentucky river at and above High Bridge, these latter (Chazy) limestones constituting the lowest or oldest sedimentary rocks exposed in the State. In addition, the group will include the portion of the Chazy which is under drainage on the Kentucky river and above the top of the Calciferous, and, in a part of the State, certain lower rocks between the Chazy and Calciferous, as mentioned later on. The total vertical thickness of the section, from low water in the Kentucky river at Camp Nelson to the top of the Trenton near Lexington, would be about 600 to 650 feet. The section would be:

	Feet.
Upper beds—Bluegrass limestones	200 to 255
Birdseye and Magnesian limestones	110
Chazy limestones	285
	600 to 650

How much thickness is to be added to this, to include the rocks below the exposed portion of the Chazy limestone down to the Calciferous, the next lower formation below the Trenton group in Central and Northern Kentucky, can not be given with accuracy at present, but it will probably not exceed 150 feet, if it be that much. Taking it at 150 feet would make the Chazy 435 feet, and the whole Trenton group about 800 feet, which agrees very closely with the thickness shown in

wells in Central Kentucky. The upper beds of the Trenton group form the surface rocks of Central Kentucky;* dipping rapidly to the east and west, they soon disappear from view and are to be found at increasing depths as the distance from the central portion increases. At Lexington, the top of the Trenton is at an elevation of about 1,000 feet above sea. At Cincinnati it is about at low water in the river, at Louisville about 750 feet below the surface, and at Owensboro probably 3,500 feet below. Going east from Cincinnati the Trenton rises for some distance, but the dip then reverses, the top of the Trenton at Ironton, on the Ohio river opposite Ashland, being given by Orton as 3,442 feet below the surface; in the southeastern part of the State it would be, roughly, from 2,500 to 3,000 feet down. The lower and middle members of the Trenton group, (the Birdseye and Chazy limestones), are seen partly above drainage along the Kentucky river, but nowhere else in the State. The Birdseye will average a little over 100 feet in thickness (including the magnesian beds), and the Chazy about 450, in Central Kentucky. Composed mostly of different shades of mottled and dove-colored limestones, the two together are readily distinguished, in the drillings, by the abrupt change from the gray limestones of the upper beds, but can not so easily be distinguished from each other, the separation of the two not being a matter of much importance to the driller anyway. The characteristic color of these limestones is very persistent and shows plainly in all wells drilled deep enough to reach them in Central Kentucky, as far north as Cincinnati and as far south as Pulaski and Wayne counties; and in Estill county to the east and Cumberland county to the southwest. The top of the Birdseye seems to be marked, over a large area in Kentucky, by a bed of light green shale from three to ten feet thick. Drillings from a deep well in Estill county show it there as a light green, shaly sand. It shows above the Birdseye at High Bridge as a light green clay, and in the Wayne county field as a white clay. In the wells of the Cumberland county fields, a light green shale—the so-called "green pencil cave" of the drillers—may possibly be at this horizon. The base of the Trenton group is marked, generally, by an abrupt change from the limestones and dolomites to a fine-grained, white, cal-

*See map No. 2 accompanying this report.

ciferous rock, with often a bed of very hard, greenish-white sandstone or quartzite at the top.

In the counties bordering on the Tennessee line and the Cumberland river, the thickness and character of the rocks composing the lower part of the Trenton group changes, and they more nearly resemble the section of the same group in the central basin of Tennessee, as they approach the State line. In Eastern Tennessee there is a great development of limestones, dolomites and shales over a sandstone, the three forming what is there known as the Knox group; the upper member of this, composed mostly of dolomites and limestones, is the Knox Dolomite of Safford. These East Tennessee rocks thin very rapidly to the north and northwest, and the shales become calcareous, but the Knox Dolomite, showing as light and dark gray and very dark limestones and dolomites, is still present under the surface rocks of Western Tennessee, and, coming northward, crosses the line into Kentucky and is present, but in rapidly reducing thickness, in the counties bordering on the State line and possibly a little farther north. The Knox Dolomite belongs above the Calciferous in the vertical section and part of it at least, if not all, in the rocks of the Trenton period (Safford describing the fossils of the Knox in Tennessee as intermingling with those of the higher rocks, with no possibility of a line between them), and its presence in Southern Kentucky, as demonstrated by well records, adds an additional thickness there to the section of the rocks of the Trenton period as given above for Central Kentucky. In Wayne county, the total thickness of rocks between the Black Shale and the Calciferous is about 1,600 feet; the Hudson is about 550 feet, and the Trenton, Birdseye and Chazy about 800, making 1,350 feet in all, thus leaving 225 to 250 feet of rocks—dark magnesian limestones—below the base of the Chazy and above the Calciferous, and representing the thinning Knox Dolomite in that section. How far north of Wayne county these lower rocks extend can not be told at present, but probably not far, as they are thinning rapidly to the north and are gone before they reach Central Kentucky. In Russell county, the total thickness between the Black Shale and the Calciferous is again about 1,600 feet, and the thickness of the whole Trenton group (including the rocks under the Chazy) is about 930 feet. The lowest rocks

are there beginning to show a change in character which becomes still more pronounced to the west and along the lower Cumberland river, agreeing more closely with the outcrop of the lowest rocks of the Trenton group in the central basin of Tennessee. In the reports on Tennessee, Safford gives the exposed portion of the Trenton group in the central basin as about 550 feet thick—probably the whole group including what is below drainage—not more than 650 feet at the most, if that much, and the Knox Dolomite underlying that. In Russell county records the rocks of the Trenton group have not thinned down that much, and it is probable that the lower 92 feet, at least, shown in the record, belong to the Knox Dolomite, although the line between the Knox and Chazy is very hard to draw in all these lower counties. Deep wells in Barren county also show the character of these lower rocks, but do not go deep enough to go through them. In the Bowling Green well a ten-foot bed of characteristic dove-colored limestone shows at 900 feet below the Black Shale and marks the top of the Birdseye, but the limestones below that have changed completely in character. The well does not go deep enough to much more than go through the Birdseye, but the change is so great that the base of the Birdseye can not be given. In the Cumberland county wells, which all start in the Hudson (which is there only about 400 feet thick), and have their depth entirely in Hudson and Trenton rocks, the change in character and thickness of the lower part of the rocks of the Trenton group is still more pronounced. The records show a long list of limestones, of varying color and hardness, a green "pencil cave" being the most constant feature found. This "pencil cave" is about 700 feet below the base of the Black Shale and possibly marks the top of the Birdseye limestone. Two records are given which show 1,000 feet of rocks below the pencil cave (making about 1,700 feet below the Black Shale) and the bottom still in limestone. When it is considered that the Hudson here is probably not more than 450 feet thick, it is apparent that there have been about 1,250 feet of limestones drilled through below the top of the Trenton (with an oil-sand nearly 1,000 feet below the top of the Trenton), and the base of the limestone series still not reached. The Trenton group in Central Kentucky (where the Knox Dolomite is gone) is about 800

feet thick, the increased thickness of over 500 feet here apparently belonging to the Knox Dolomite, which outcrops farther to the southwest in Tennessee. The exact lines here between the base of the Chazy and the top of the Knox can not be drawn in the records. Much of the trouble in distinguishing these lines may be due to descriptions given by different drillers and may be entirely cleared up when samples of the drillings from this field are available. Such drillings as have been saved show the Birdseye and Chazy limestones as practically unchanged in character from what they show in Central Kentucky.

The Trenton limestones have been the source of enormous supplies of oil and gas in Ohio and Indiana, but, until recently, have not been productive in Kentucky (unless the oil from some of the old Cumberland river wells came from the Trenton), although it can not be said that they have been tested in many places. More recently, however, wells in Wayne county have produced oil from the lower Sunnybrook sand, at a depth of about 550 to 600 feet below the Black Shale, which must come from the upper part of the Trenton, and in Clinton and Barren counties some oil and gas has been found at about the same place and still farther down, while in Cumberland county a number of good producing wells have been recently drilled, striking the oil at several different horizons, all of which (with the exception of the most shallow horizons in a few of the wells, which were in the lower part of the Hudson), were in the Trenton group. Judging from the results in the above-mentioned counties, it may reasonably be expected to find productive territory in the rocks of the Trenton group, not only in other parts of these counties, but also in other counties bordering on the Cumberland river as well, and possibly in other parts of the State where the Trenton may be within reaching distance and other conditions favorable.

THE CALCIFEROUS.

Immediately below the Trenton group in this State is found a fine-grained, white, porous, sandy limestone, with sometimes a hard, greenish-white sandstone or quartzite at the top. It has been drilled into at a number of points, always showing

approximately the same characteristics. Its thickness, as shown by a well at Frankfort, is not less than 700 feet. The Calciferous has nearly always, when drilled into in Kentucky, proved the source of strong brines and mineral waters, the "Blue Lick" water of Central Kentucky being ascribed to this formation, and the water from the St. Patrick well at Louisville probably coming from it also. Nowhere in Kentucky, so far as known, with the exception of a well on White Oak creek in Estill county, has the Calciferous given definite promise as a producer of oil or gas, and in the light of present development the prospect for any from this formation seems very small; at the same time, older rocks have produced gas (a flow from a well in New York being credited to the Potsdam sandstone), and the facts that these rocks are porous and carry brines, would go to prove that accumulations of gas and oil in them are not a matter of impossibility.

CHAPTER IV.

The Oil Sands Corresponding to the Different Formations.

The Conglomerate Series.

BEAVER, HORTON, PIKE AND SALT SANDS.

In Floyd, Knott, Pike and Martin counties considerable drilling has been done, and the Conglomerate series shown to be strongly developed, averaging from 600 to 1,000 feet in thickness and consisting of a series of alternating sandstones, shales and slates, with some included coals. These beds of sand and shale are quite variable in number and thickness, the sands, especially, changing rapidly in thickness or breaking up by the intervention of beds of shale; but the drill has developed four well-marked and fairly persistent sands, which have been given local names of Beaver, Horton, Pike and Salt sands, all of them producing, in places, either oil, gas or salt water. In this

Conglomerate series is found the oil field of Floyd and Knott counties, producing the Whitehouse oil, which is piped to market and has heretofore commanded a higher price than any other Kentucky oil. This Conglomerate group is so variable and changes so rapidly in a short distance, that any detailed description of these sands can hardly be given. The records of drilled wells, given later on, will show more clearly their order and thickness.

WAGES, JONES AND EPPERSON SANDS.

In Knox and Whitley counties the Conglomerate measures average about 800 to 900 feet thick and present about the same characteristics as in Floyd, Knott, Pike and Martin, with the exception that the sands are much closer to the surface and seem to be somewhat more broken by intervening beds of slate. Three sands have been developed as producers, the Wages, Jones and Epperson, with a fourth lower down shown in some wells, but not named. These four sands correspond approximately with the four previously described in the Floyd and Knott field. In Knox considerable confusion has been caused by the manner in which the sands are frequently cut out, and it is quite probable that the sands themselves have often been mistaken, the one for the other, by the drillers. Most of the drilling in Knox has been to these shallow sands and it can not be said that the prospect for long-lived wells in these sands is very flattering. A few deeper wells have been drilled, but records of most of them are not available. A record of a deep well at Gray's Station is given and enough other records to show the average section and the positions of the sands.

Waverly Group.

BIG INJUN, KEENER AND SQUAW SANDS.

The Big Injun group lies directly under the Mountan Limestone and generally separated from it by a thin bed of slate. In its full development it would show as follows:

Mountain Lime—St. Louis L. S. Group.

Slate,	
Sand.....Keener,	
Slate,	
Sand.....Big Injun,	Big Injun Group.
Slate,	
Sand.....Squaw,	

No. 5. Big Injun Sand on Brush creek, L. & N. Railroad, Rockcastle County.

The members of the Big Injun group vary very considerably, both in thickness and character, and one or more of them are generally absent, the full group as represented above rarely showing. When separated, the first sand at the top becomes the Keener, the second sand the Big Injun, and the third, or bottom sand, the Squaw, of the Ohio and West Virginia fields. In Kentucky the Big Injun has been definitely recognized in Pike and Martin counties, where it is a source of gas in large quantities, and in Magoffin, Johnson, Knox and Whitley counties. In a well near Barboursville, in Knox county, it gave a large flow of gas at about 1,400 feet. In Whitley county it shows in the well records at about 1,300 feet, and in Rockcastle county can be seen in outcrop along the L. & N. R. R. a few miles north of Livingston. Plate No. 5, taken at Brush Creek, on the L. & N. Railroad, north of Livingston, Rockcastle county, shows the full thickness (about 30 feet) of the Big Injun on outcrop. Plate No. 6 gives an enlarged view of the heavy sandstone ledge at the base. The group there consists of the above-mentioned heavy ledge at the base, with thinner sandstone ledges above and a yellow, limy sandstone at the top. The whole group is separated from the overlying St. Louis by about 40 feet of material, part of which is slate and part covered. At the base of the group is a soft shale. It would seem from the records of drilled wells that the Big Injun will be found, of varying thickness, but always present, in the counties above named and probably also in all the counties south of a line roughly drawn from the northern part of Martin county, to Mt. Vernon, in Rockcastle county, and as far west as the southern part of Wayne and Clinton counties. Its position in the wells in the above counties will be shown later on in the records given of wells drilled in those counties.

In this connection it might be well to mention a sand which is found in Carter, Boyd, Rowan, Morgan and possibly some other adjoining counties, which comes a little lower down in the Waverly—farther below the St. Louis limestone than the Big Injun should be—which nearly always shows more or less oil, gas or salt water, and may possibly represent the Big Injun in those counties. In Boyd county wells this sandstone gave gas and salt water; in Morgan county it gave oil shows over

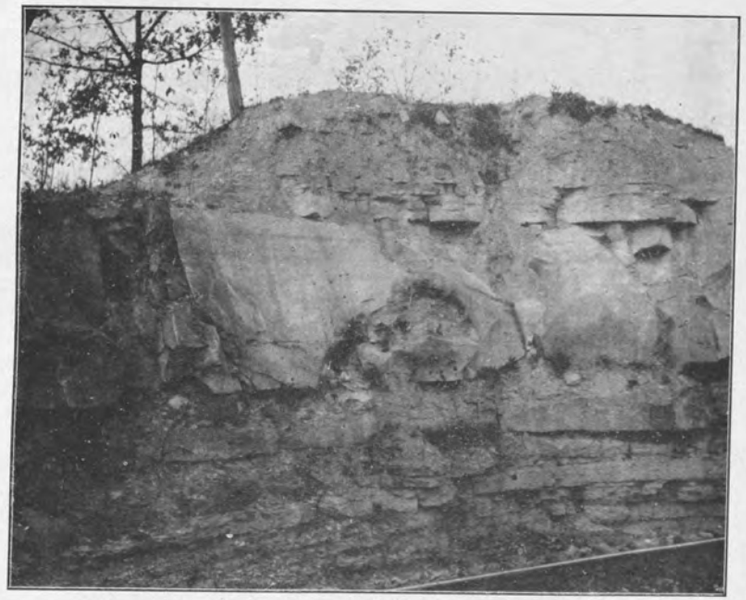
a vertical distance of 150 feet, and at the same horizon in Breathitt county, a strong flow of salt water. It can be seen in outcrop near Gates on the C. & O. R. R., in Rowan county. If not the Big Injun sand, it is not far below it in position and is certainly well worth watching in any drilling done where it is under cover.

THE CLOVERPORT GAS SAND.

Detailed descriptions of the Cloverport gas field are given in reports of the Kentucky Geological Survey on the "Geology of Breckenridge County" and on "Petroleum, Gas, Etc., in Western Kentucky." The gas "sand" is an open, porous, dark gray limestone about fifteen feet thick, found in the Keokuk division of the Waverly group, at a depth of 872 feet below the surface. It corresponds very closely in position to the gas-bearing rocks of Warren county described in Dr. Orton's report cited herein, and has proved to be the source of a rather long-lived field at Cloverport. Comparatively little drilling has been done in the counties of Western Kentucky, where this sand is to be found under cover and at a moderate depth, and future work along the lines of some of the numerous folds which are to be found there may yet develop important fields from this horizon.

THE BEREA GRIT.

The Berea Grit, next to the Trenton limestone, has proved to be the most productive oil sand in Ohio, but has not been tested to any great extent in the Kentucky fields. It is the first heavy sandstone lying above the Devonian shales, and, under cover, extends over a large territory in Ohio, Kentucky and West Virginia. Under cover, it is nearly always the source of more or less oil, gas or salt water, while on outcrop it gives valuable quarries of building stones and flagstones, the well-known Rowan county freestone quarries along the C. & O. Railroad being in this formation. Plate No. 7, taken at one of the quarries near Farmer's, Rowan county, shows these ledges of freestone. As exposed there, the Berea lies just above the Black Shale and consists of ledges of fine-grained sandstone of different thicknesses, the ledges separated by thin beds of shale and quarrying with great regularity. Over the Berea Grit



No. 6. Heavy ledge at base of Big Injun Sand in Rockcastle County.

lies a bed of very black shale, the Berea Shale, averaging about ten feet in thickness and strongly resembling the Devonian Black Shale. This black Berea Shale forms a valuable landmark to the driller, drilling very black and soft, the Berea Grit coming just beneath it and between it and the Devonian Black Shale. The Berea Grit crosses the Ohio river in the eastern part of Lewis county, and outcrops in an irregular line as far south as Powell county, beyond which point it may still occur, but has not been seen.* The following section of the rocks in Lewis county shows its position and thickness there:

	Thickness.	Total Height.	Geological Formation.
Thin, shaly sandstones to top of hill.	190	885	Waverly.
"Buena Vista" building stones	140	695	
Red and green shales	15	555	
Covered (shales and thin S. S.'s)	30	540	
Black Berea Shale	10 to 15	510	
Berea Grit ("Rowan County Stone")	75	500	
Covered	10	425	
Gray clay shales	15	415	
Black shale	40	400	Devonian Shales.
Light dove-colored and light-green shales	40	360	
Black shale	170	320	
Magnesian limestones	50	150	Corniferous and Upper Silurian.
Light-colored shales	about 100	100	Niagara Shale.

In Rowan county the Berea Grit is the freestone which is quarried on the C. & O. R. R. at Farmer, Freestone and Rockville. At Farmer the Black Shale shows with its base just about at the river and the Berea is in the quarry on top of the hill; going east, the quarries get closer down to the railroad with the southeasterly dip of the rocks, the Black Shale going beneath drainage about half way between Farmer and Morehead; while the top of the Berea, with the overlying Berea shale, goes under at a point about two miles west of Morehead, to be succeeded by the ledges of the overlying Buena Vista between that point and Morehead.

West of the Licking river the Berea Grit has almost entirely disappeared. To the south it shows, very thin and patchy, along the L. & E. Railroad, above Clay City, but was not seen at all in Estill county, and that may prove to be its extreme southern limit. It is interesting to note, at this point, that the

*See map No. 2 accompanying this report.

Beaver and Cooper sands of Wayne county are found at just about the same place in the section as the Berea Grit is farther north, and that through all the southern tier of Kentucky counties, as far west as the southern edge of Wayne county, and also in the northern counties of Tennessee, as far as Fentress county, an oil-bearing horizon is found at about the same place.

Under cover, the Berea Grit will be found in all the counties east of an irregular line drawn from the mouth of Kinniconick creek in Lewis county to Torrent on the L. & E. Railroad, and north of a line from Campton to Prestonsburg on the Big Sandy river, but at increasing depths in proportion to its distance to the east. In the counties farther south it is probably not present, although but little drilling has been done to test it. In the extreme eastern and southeastern counties of the State the Berea if present, would be at a considerable depth, owing to the increased thickness of the Conglomerate series and the dip of the rocks. Its position will be shown in records, given farther on, of wells at Portsmouth and Ironton, Ohio, and in Boyd, Carter, Lawrence, Rowan, Morgan and Martin counties.

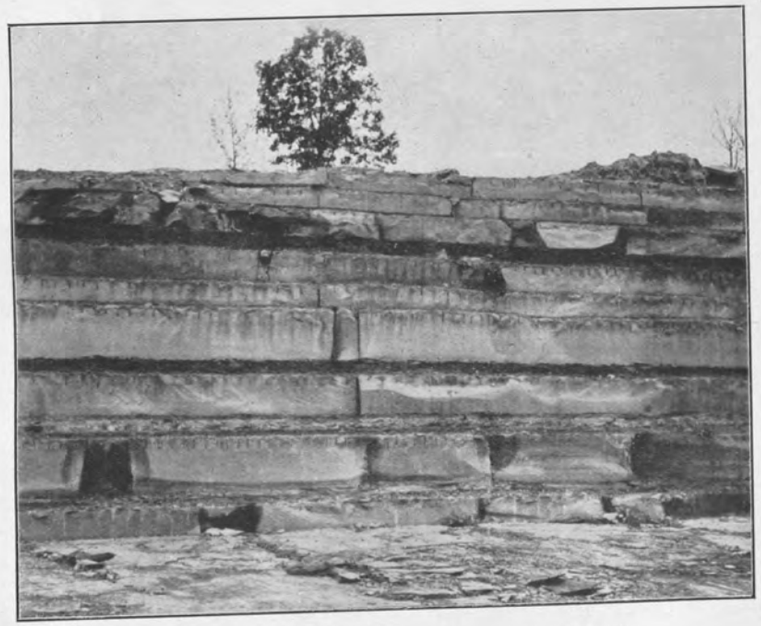
The Berea in Kentucky is of closer, finer grain than in Ohio, but wherever drilled through, shows more or less gas or oil, and as drilling progresses in the eastern counties, may prove to possess valuable oil fields within its limits.

The Devonian.

THE BLACK SHALE.

The Black Shale, wherever tested under cover, carries a large percentage of oil disseminated through it and furnishes the oil for numerous oil springs along its outcrop. When drilled through, it often gives shows of oil and gas all the way through it, especially at points where a hard layer in the shale forms a cap or shell. In other States it has been found to be a reservoir for low-pressure gas in moderate quantities, but in Kentucky it has, so far, with but one notable exception, given neither gas nor oil in large amounts. The structure of the shale itself is not favorable for the accumulation of oil in reservoirs unless somewhere a sandstone should be found imbedded in it.

The exception above referred to is the well-known Meade county field, where gas was found in the Black Shale and piped to Louisville. The gas there seems to be in direct contact with



No. 7. Berea Sandstone in quarry near Farmers, Rowan County.

salt water, little or no oil coming in the wells. A detailed description of this field is given in a report on the geology of Meade county, by Dr. Loughridge, Kentucky Geological Survey.*

THE RAGLAND SAND.

The general features of the Corniferous Limestone and its approximate line of outcrop have already been given on a preceding page. Its importance in this State is due to the fact that it is the source of a large supply of gas in one field (the Menefee county field) and of the oil in two well-developed oil fields—the Ragland field in Bath county and the Estill county field, near Irvine, and that it may, under cover, develop more in the future. Much confusion among operators and drillers has been caused by the identification of the Ragland sand as Clinton when the Bath county field was being developed. Since that identification, much drilling has been done in Eastern Kentucky in search of the Clinton sand, supposing it to be the same as the Ragland, whereas the two are entirely different and separated from each other by a mass of soft, light-colored shales —the Niagara shales—with sometimes the Niagara limestone also showing on top of the shales. In the Bath county field records of wells, in almost every instance, showed a bed of what the drillers called soft white "fire-clay," averaging six to eight feet in thickness, near the base of the Devonian Black Shale and but a short distance above the oil-sand. This white clay was taken to be the Niagara shales cut down in thickness, and the underlying oil rock, which was a limestone, to be the next limestone in the descending order or Clinton. As a matter of fact, the Niagara shales have thickened considerably there instead of being cut down, showing a thickness of about 125 feet on outcrop only a few miles away. The fact that the Devonian Black Shale often contains beds of soft, nearly white shale, not only near the base but higher up in the section as well, and the additional fact that wherever the white "fire-clay" was drilled through in the wells, the drillers reported immediately under it and between it and the oil rock, about ten feet of dark brown shale, was entirely overlooked, and the oil

*This report, which was prepared during the administration of the late John R. Procter, has not yet been published. It will be brought to date and sent to press within a few months.—C. J. N.

rock called Clinton when it should have been classed as Corniferous. An average record of the wells in Bath county taken from the records of about fifty wells would be about as follows:

	Thickness.	Depth.	Formation.
Gravel	20	20	Waverly.
Blue shale	167	187	
Black shale	205	392	Devonian Shales.
White "fire clay"	8	400	
Brown shale	12	412	
Oil sand	14	426	Devonian—Corniferous L. S.

A section taken on the outcrop about eight miles northwest of the Ragland field, and starting on the Clinton iron ore and going up into the Waverly, gave:

	Thickness.	Total Height.	Formation.
Shales and sands to top of hill	..	430	Waverly.
Gray sands and shales	55	417	
Sand ledge	2	362	
Gray shales	25	360	
Hard sand ledge	6"		
Soft black shale	15	335	Devonian Shales.
White clay shale	10	320	
Black shale	35	310	
White and gray clay shale	10	275	
Black and brown shales	110	265	
White clay shales	about 5	155	
Dark-brown shale	10	150	
White clay shale	2	140	
Corniferous limestone	4	138	Corniferous.
Niagara shales	about 125	134	Niagara.
Clinton limestones and shales	9	9	Clinton.
Top of Clinton iron ore		0	

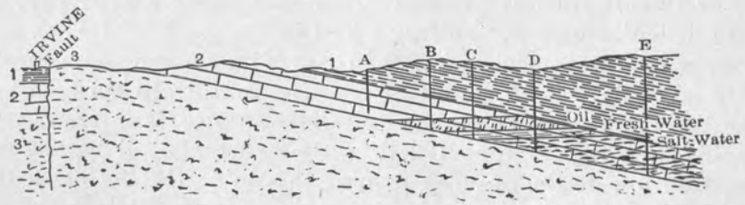
On this outcrop the Corniferous has begun to thin down (as mentioned under heading of "Corniferous" on a preceding page), showing and disappearing again, from the C. & O. Railroad north to the Ohio river and across to Highland county, Ohio. The section shows too plainly for any doubt, that the bed of white "fire-clay" of the drillers was the bed at 150 to 155 in the above section, underlaid in the wells as in the section by ten to twelve feet of brown Devonian shale, and that the oil rock under that was the Corniferous limestone. As additional evidence that the Ragland sand is Corniferous and not Clinton, attention is called to records of wells drilled in the Bath county field

through the Niagara and down to lower depths. These records will be given later on under Bath county wells and they show not only the "fire-clay" with the brown shale under it, and the Ragland sand (Corniferous) under that, but also the Niagara shales under the Ragland and developed to an unusual thickness.

Estill County Field.—In the field, near Irvine, the majority of the wells start below the Waverly in the Black Shale itself, and strike the oil-rock at depths of from 70 to 90 feet. The white shale (white fire-clay of the drillers) shows in places near the base of the Black Shale and above the oil rock, as at Ragland, and in other parts of the field is cut out. The oil rock is the Corniferous and shows in outcrop about a mile west of the oil field, along the railroad and in the town of Irvine, underlaid by the Niagara shales in considerable thickness, probably 75 to 85 feet of the latter showing in a drain between the railroad depot and Irvine. In the wells a white limestone carrying fresh water is reported directly under the oil rock. An examination of the outcrop proved this to be the bottom ledge of the Corniferous. (As explained on a preceding page, by Corniferous here is meant the whole limestone formation from the top of the Niagara shale to the base of the Black Shale. The lower two or three ledges may belong to the "Water Lime" of Ohio, and the Niagara limestone, below the Corniferous proper.)

This Estill county field illustrates very nicely the anticlinal theory of the storage of oil in the rocks. Just at the edge of Irvine on the east is the top of what was an anticlinal fold, but one which broke at the top. Between the railroad bridge over the river and the crossing at Main street, the Corniferous is exposed in the railroad cuts with the Black Shale over it and the Niagara Shale under it. Near the bridge, a fault brings the Black Shale down close to the river; between the bridge and town several small faults show, but the rocks are nearly horizontal; at the Main street crossing the Corniferous shows in a cut on the west side and a fault or uplift shows very plainly at the same place. This fault brings the top of the Niagara shale on the east side of Main street above the level of the top of the Corniferous on the west side of the street. From this point the rocks seem to rise very slightly to the east for a short distance, then bend and fall

rapidly to the east (the Corniferous being below the river at the oil field) and form a long monocline with its axis just east of Irvine and the oil field still farther east and down the slope. Wells drilled on this monocline show, near the axis, dry holes; farther down the dip, oil; still farther down, oil, underlaid by fresh water, and still farther down the slope salt water alone. The fresh water has evidently come in from the river, and the contents of the rocks have arranged themselves in order of their specific gravity, the salt water below and the oil above, the latter rising up the dip only far enough to keep ahead of the water, and wells above that point giving no oil.



Sketch of Formation of Estill County Oil Field.

1. Devonian Black Shale; 2. Corniferous L. S.—Ragland Sand; 3. Niagara Shale. Well at A, dry; well at B, some oil; well at C, oil and fresh water; well at D, oil and salt water; well at E, salt water.

As stated on a preceding page, the Corniferous, which already has two oil fields and a gas field to its credit, underlies a large area, extending from its outcrop and from the Ohio river, east and south, to an unknown distance, and somewhere within this area may give other profitable fields in the future. As it goes east, however, its depth below the surface rapidly increases and it soon gets too far below to reach. Professor White has identified it in a well near Huntington, W. Va., at a depth of 2,770 feet.

The Clinton.

THE CLINTON SAND.

The Clinton underlies a very large area in Kentucky and has been drilled through in a great number of wells, often showing more or less oil and gas, but so far, nothing worthy of special note except in the Morgan county field and possibly the Wolfe county or Campton field.* In Morgan county, it is the source of a high-grade green oil and gives a field of much promise. The "oil-sand," as found in Morgan county, lies about forty feet below the base of the Black Shale and near the top of the Clinton group. Under the Black Shale is found a few feet of Corniferous limestone, and under that about thirty feet of soft Niagara shales. Directly under the Niagara shale is an exceedingly hard, dense, impure limestone cap, varying from three to eight feet in thickness, and under that the oil-sand, the latter about thirty-five feet thick and consisting of a firm gray rock, partly sand, but cemented together with lime, and quite porous. It varies considerably in hardness in different parts of its thickness, two or three "pay" streaks being quite soft, and the rest of it rather hard. The extent of territory underlaid by the sand, in the form in which it is found here, is unknown, but little drilling having been done in the counties to the east and south.

The Hudson Group.

THE CANEY SAND.

The principal development of this sand so far has been in Morgan county, on Caney creek, and at West Liberty, but it has also been found productive in Breathitt county and at Campton in Wolfe county. The "sand" is a bed of open, porous sandstone, sometimes gray and sometimes white, included in the limestone series of the upper part of the Hudson group, and under a dense, close-grained, impure limestone cap. This cap is from three to five feet in thick-

*See note under record of Wolfe county wells.

ness and very hard. The sand is found on Caney creek at 1,525 to 1,600 feet below the surface and 125 feet below the base of the Niagara shale. Its position on the geological scale is below the Clinton and not far below the top of the Hudson. This sand is shown in outcrop in Montgomery, Clark and Madison counties and is oil-bearing even on outcrop. The Caney sand in Morgan county is the source of high-pressure gas and an excellent quality of green oil, but not enough development has been done to determine the extent of territory underlaid by it, or test its productiveness. There is a large area in the western tier of counties of the Eastern Coal-field where this sand can easily be reached by the drill and where, as yet, little drilling has been done. In the eastern part of the coal-field the thickening of the Conglomerate measures and the Devonian shales to the southeast, combined with the dip of the rocks in the same direction, have put this sand at depths too great to be reached.

Wayne County Sands.

THE STRAY, BEAVER, COOPER, ETC.

In the Wayne fields oil and gas are found at a number of horizons below the St. Louis limestones. Most of the wells start either in the St. Louis or the Keokuk division of the Waverly group.

The highest oil rock in the scale, so far as known at present, is what is known there as the "Stray" sand, which is found in the Keokuk at a point about 250 feet above the Black Shale. It is by no means regular as an oil producer, but has produced oil in sufficient quantities to make it worthy of note, being credited with about 9,000 barrels at one point. The oil from this rock is a black, heavy oil, quite different from the other Wayne county oils.

At Mt. Pisgah, wells have been drilled which are producing large volumes of gas. If the records of the wells are correct, this gas was struck at a depth of about 260 feet and about 170 feet above the Black Shale, which would make it in the Waverly group, but at a different horizon from any other known.

The best-known and largest producing oil-sand in the county, and, at present, the largest producer in the State, is the next in descending order—the Beaver-Cooper-Otter-Slickford sand.

It is found near the base of the Waverly, averaging probably forty feet above the top of the Black Shale. Between it and the Black Shale is generally a bed of very dark slate, constituting the base of the Waverly group. The Beaver averages about fourteen to sixteen feet thick and, like all the other Wayne county oil rocks, is a limestone, in places, however, carrying some white sand mixed with the lime.

The next lower sand is the Sunnybrook, a horizon given as about 330 to 350 feet below the Black Shale and evidently belonging in the lower part of the Hudson group and corresponding closely in position to an oil-bearing horizon found at about the same place in the Hudson at a number of places in Kentucky. In Wayne the Sunnybrook is commonly called 150 to 200 feet thick and an oil obtained at a depth of about 600 feet below the black shale is credited to the same rock and also called Sunnybrook oil. When the records of wells in Wayne and some of the other river counties are compared, however, it will readily be seen that they constitute two different sands—the upper and lower Sunnybrook. The first would belong to the lower part of the Hudson and the other in the upper part of the Trenton group.

A sand (sometimes a sandy limestone) is present in the southern edge of Wayne county, which is just about at the place of the Big Injun, and probably represents that group. Not enough development has been done in that part of the county where it is under best cover, to tell whether it can be classed among the producers in this county or not.

In Record No. 2 of the Wayne county wells, given later on, is shown a sand with a show of oil near the bottom of the Trenton group and only a short distance above the top of the Calciferous. So far as known, this is, with a single exception, the deepest oil-sand yet found in Kentucky, but, as it is not shown in other deep well records, not much importance can, at present, be attached to it.

No. 4—Ragland farm.

	Thickness.	Depth.	Geological Formation.
Lime	40	40	St. Louis.
Blue shale	503	543	Waverly.
Black shale	205	748	Devonian Shales.
White fire-clay	8	756	
Brown shale	12	768	
Oil sand	18	786	Ragland (Corniferous).

No. 5—Ragland farm.

Gravel	15	15	Waverly.
Blue shale	533	548	
Black shale	205	753	Devonian Shales.
White fire-clay	8	761	
Brown shale	12	773	
Oil sand	18	791	Ragland (Corniferous).

No. 6—Ragland farm.

Blue lime	40	40	St. Louis.
Blue shale	607	647	Waverly.
Black shale	205	852	Devonian Shales.
White fire-clay	8	860	
Brown shale	12	872	
Oil sand	15	887	Ragland (Corniferous).

No. 7—Ragland farm.

Gravel	18	18	Waverly.
Blue shale	173	191	
Black shale	205	396	Devonian Shales.
White fire-clay	8	404	
Brown shale	12	416	
Oil sand	10	426	Ragland (Corniferous).

No. 8—Ragland farm.

Lime	40	40	St. Louis.
Blue shale	503	543	Waverly.
Black shale	205	748	Devonian Shales.
White fire-clay	8	756	
Brown shale	12	768	
Oil sand	25	793	Ragland (Corniferous).

No. 9—Ragland farm.

Gravel	20	20	Waverly.
Blue shale	141	161	
Black shale	205	366	Devonian Shales.
White fire-clay	8	374	
Brown shale	12	386	
Oil sand	19	405	Ragland (Corniferous).

No. 10—Ewing farm.

Lime	50	50	St. Louis.
White slate	561	611	Waverly.
Black shale	205	816	Devonian Shales.
Fire-clay	8	824	
Brown shale	15	839	
Oil sand	31	870	Ragland (Corniferous).

The above ten records are of typical wells drilled into the Ragland sand. Below are given records of wells in the same field, drilled down deeper and showing a heavy bed of Niagara shales under the Ragland sand. All are in the Ragland field.

No. 11—Wooley farm.

	Thickness.	Depth.	Geological Formation.
Gravel	20	20	Waverly.
Blue shale	250	270	
Black shale	205	475	Devonian Shales.
White fire-clay	8	483	
Brown shale	12	495	
Ragland sand	30	525	Corniferous L. S.
Blue shale	179	704	Niagara Shales.
Second sand	20	724	Clinton.

No. 12—Wooley farm.

Sand and gravel	15	15	
Black shale	145	160	Devonian ("fire-clay" at base cut out).
Ragland sand (oil show)	28	188	Corniferous.
Red mud	157	345	Niagara Shales.
Second sand	10	355	Clinton "oil sand."
Blue mud	25	380	Probably all Clinton.
Hard, red sand	8	388	
Soft, gritty lime	16	404	Hudson.
Dark lime	96	500	

The red sand at 380 to 388 may be Medina.

No. 13—Ewing farm.

Gravel	56	56	
Blue shale	607	663	Waverly.
Black shale	205	868	Devonian Shales.
White fire-clay	8	876	
Brown shale	12	888	
Oil sand	30	918	Corniferous L. S.
Red mud	245	1,163	Niagara Shales.
Second sand	15	1,178	Clinton "oil sand."
Mud	15	1,193	Clinton.

No. 14—Ragland farm.

Gravel	20	20	Waverly.
Blue shale	61	81	
Black shale	205	286	Devonian Shales.
White fire-clay	8	294	
Black shale	12	306	
Oil sand	missing		
Blue mud	178	484	Niagara Shales.
Second sand	10	494	Clinton "oil sand."

Numbers 11, 12, 13 and 14 all show a bed of Niagara shales of unusual thickness *below* the Ragland oil sand.

ROWAN COUNTY WELLS.

No. 1—Butts farm.

	Thickness.	Depth.	Geological Formation.
Brown quicksand	25	25	Waverly.
Hard, white lime	50	75	
Open, white lime	75	230	
White shale	80	230	
White lime	110	340	
White shale	110	450	
Brown shale	40	490	Devonian Shales.
White sand	10	500	
Brown shale	190	690	
White fire-clay	5	695	
Ragland sand (salt water)	100	795	Will include Ragland and Niagara.
Red rock	50	845	
White shale	55	900	
Lime shells	200	1,100	Clinton and Hudson.
Hard lime	460	1,560	

Well is about down to top of Trenton.

No. 2—Triplett Creek, 12 miles N. E. of Morehead.

Soil	5	5	
Blue shale	62	67	Waverly.
Black slate	10	77	Berea Shale.
Blue and green shales (gas at 171)	94	171	Gas at place of Berea Grit.
Mixed shales	29	200	Bedford (?)
Red rock	6	206	
Black shale	329	535	Devonian Shale.
Soft lime (oil and salt water)	7	542	Corniferous (Ragland).

MENEFEE COUNTY WELLS.

No. 1—G. W. Gay farm.

	Thickness.	Depth.	Geological Formation.
Soil	5	5	Waverly.
Blue clay	10	15	
White soapstone	90	105	
Blue slate	50	155	
Hard, gray lime	10	165	
White soapstone	3	168	
Soft, blue slate	70	238	
Hard, blue slate	94	332	
Black shale	136	468	Devonian Shales.
White fire-clay	6	474	
Hard, brown shale	7	481	
Gas sand (gas)	19	500	Corniferous—Ragland sand.

No. 2—Elijah Mynhier farm.

	Thickness.	Depth.	Geological Formation.
Clay	10	10	Waverly.
Soft, blue shale	50	60	
Dark, hard lime	10	70	
Blue soapstone	75	145	
Blue slate	10	155	
Light soapstone	4	159	
Dark, hard lime	16	175	
Blue slate	46	221	
Light soapstone	22	243	
Blue slate	5	248	
Light soapstone	9	257	
Hard, dark slate	18	275	
Soft, light slate	23	298	
Hard, gray lime	5	303	
Hard, black shale	137	440	Devonian Shales.
Soft, blue slate	12	452	
Gas lime (gas)	26	478	Corniferous L. S.—(Ragland.)

No. 3—G. W. Poynter, No. 1.

Clay	6	6	
Dark sandstone	144	150	Waverly.
Blue shale	220	370	
Black shale	150	520	Devonian Shales.
Blue shale	8	528	
Dark lime (gas at 530)	12	540	Corniferous L. S.
Light lime (gas, 542 to 563)	23	563	
Blue shale	2	565	Niagara.

No. 4—G. W. Poynter, No. 2.

Clay	7	7	
Dark sandstone	79	86	Waverly.
Blue shale	194	280	
Light shale	133	413	
Black shale	144	557	Devonian Shales.
Blue shale	6	563	
Black shale	1	564	
Dark lime	1	565	Corniferous L. S.
Gray lime (gas)	35	600	
Black lime	1	601	
Blue shale	3	604	Niagara.

A measurement by Pitot tube gave 1,191,816 cubic feet of gas in 24 hours.

No. 5—T. E. Amburgy farm.

Clay	23	23	Waverly.
Blue sand	222	245	
Pink shale	10	255	
Blue shale	215	470	
Gray lime	5	475	
Blue shale	10	485	
Black shale	165	650	Devonian Shales.
Blue shale	5	655	
Ragland sand	15	670	Corniferous L. S.
Ragland sand (gas)	30	700	

1,112,544 cubic feet of gas per day.

No. 6—W. F. Fitzpatrick farm.

	Thickness.	Depth.	Geological Formation.
Clay	5	5	
Dark shale	15	20	Waverly.
Light sand	10	30	
Dark sand	10	40	
Light sand	10	50	
Dark shale	267	317	
Light shale	9	326	
Black shale	40	366	Devonian Shales.
Dark brown shale	102	468	
Blue shale	5	473	
Dark lime (gas)	10	483	Corniferous L. S.
Light lime (gas)	8	491	
Dark lime (gas)	4	495	
Light lime (gas)	4	499	
Blue shale	4	503	Niagara.

No. 7—John Fecraft farm.

Clay	7	7	
Dark sand	61	68	Waverly.
Blue shale	4	72	
Dark sand	21	93	
Blue shale	1	94	
Dark sand	6	100	
Blue shale	45	145	
Dark sand	3	148	
Blue shale	12	160	
Dark sand	10	170	
Blue shale	13	183	
Dark sand	11	194	
Blue shale	318	512	
Gray lime	2	514	
Blue shale	6	520	
Gray lime	2	522	
Blue shale	8	530	
Black shale	6	536	Devonian Shales.
Blue shale	9	545	
Black shale	98	643	
Brown shale	58	701	
Blue shale	9	710	
Dark lime (gas)	36	746	Corniferous L. S.
Blue shale	5	751	Niagara.
Gray lime	5	756	
Blue shale	68	824	

No. 8—G. W. Miller farm.

Clay	9	9	
Dark sand	176	185	Waverly.
Blue shale	236	421	
Dark lime	22[2]	443[2]	
Black shale	143[2]	587	Devonian Shales.
Blue shale	8	595	
Dark lime	16	611	Corniferous L. S.
Light lime (gas)	10	621	
Blue shale	7	628	Niagara.

No. 9—Jack. Barnett farm.

	Thickness.	Depth.	Geological Formation.
Clay	10	10	
Dark sand	62	72	Waverly.
Gray sand	13	85	
Blue sand	55	140	
Blue slate	140	280	
Dark lime	5	285	
Blue shale	13	298	
Dark lime	4	302	
Blue shale	145	447	
Gray lime	2	449	
Black shale	91	540	Devonian Shales.
Brown shale	43	583	
Blue shale	12	595	
Brown shale	8	603	
Blue shale	5	608	
Dark lime (gas)	12	620	Corniferous L. S.
Blue shale	153	775	Niagara.

No. 10—Catherine Tabor farm.

Clay	9	9	
Blue sand	111	120	Waverly.
Dark sand	270	390	
Yellow lime	2	392	
Dark sand	98	490	
Yellow lime	2	492	
Blue shale	25	517	
Black shale	153	670	Devonian Shales.
Blue shale	10	680	
Dark lime	14	694	Corniferous L. S.
Light lime (gas)	9	703	
Blue shale	7	710	Niagara.

MONTGOMERY COUNTY WELLS.

No. 1—Mt. Sterling.

	Thickness.	Depth.
Clay	4	4
Blue lime	631	635
"Trenton"	80	715
Hard, blue and gray lime	288	1,003

No. 2—Spencer Creek.

Drift	8	8
Blue lime	763	771
"Trenton"	80	851
Lime	252	1,103

The separation of the Trenton in these two wells was made by the driller. The wells are entirely within the Hudson and Trenton Groups.

CLARK COUNTY WELL.

Deep Well on Lulbegrud Creek.

Well started at base of black shale.
Records from top down to 1,050 were lost.
1,050 to 1,090, fine-grained, dove-colored limestone.
At 1,200, fine-grained, bluish-gray limestone.
1,240-1,255, very light, dove-colored limestone.
At 1,378, dark, reddish-gray lime, mixed with nearly black lime. Oil smell.
1,390-1,400, dark, dove-colored limestone.

These rocks correspond to the Birdseye and Chazy limestones seen at High Bridge and Camp Nelson on the Kentucky river and belong in the lower part of the Trenton period. The well did not go deep enough to reach the bottom of the Chazy.

POWELL COUNTY WELLS.

No. 1—James Welsh farm.

	Thickness.	Depth.	Geological Formation.
Clay	17	17	Devonian Shales.
Black shale	8	25	
Hard, brown flint	24	49	Corniferous.
Yellow soapstone	65	114	Niagara Shale.
Hard, blue lime (oil at 133)	19	133	Clinton.
Soapstone	14	147	
Blue lime (gas at 310)	509	656	Hudson and Trenton.
White lime	25	681	
Brown shale	19	700	
White lime	9	709	
Blue lime	66	775	
Brown lime	20	795	
Blue lime	90	885	
Bottom at		951	

(Compare record of Well No. 7, Estill county.)

No. 2—Luther Stephens' farm.

	Thickness.	Depth.	Geological Formation.
Clay	13	13	Devonian Shales (Ragland sand missing).
Black shale	117	130	
Soapstone	62	192	Niagara Shale.
Brown lime (oil show)	4	196	Clinton.
Blue soapstone	10	206	
Blue lime	976	1,182	Hudson and Trenton.
Brown lime	10	1,192	
Blue lime	15	1,207	

In both No. 1 and No. 2, a few feet of the limestone at the top of what is marked "Hudson and Trenton" probably belong to the Clinton.

No. 3—Luther Stephens' farm.

	Thickness.	Depth.	Geological Formation.
Clay	14	14	Devonian Shales.
Black shale	126	140	
Gray lime	10	150	Ragland Sand (Corniferous).
Soapstone	45	195	Niagara Shale.
Brown lime (oil)	3[2]	198[2]	Clinton.
Soapstone	10[2]	209	
Blue and gray lime	31	240	Hudson.
Brown lime	5	245	
Blue lime	59	304	(A part or all of the 31 feet may be Clinton.)

No. 4—Miles Forkner farm.

	Thickness.	Depth.	Geological Formation.
Clay	14	14	Devonian Shales.
Black shale	118	132	
Soapstone	3	135	
Hard, gray lime	7	142	Ragland Sand (Corniferous).
Soapstone	53	195	Niagara Shale.
Gray lime	3	198	Possibly all Clinton.
Soapstone	12	210	
Gray lime (oil)	20	230	
Gray, brown and blue lime	21	251	Hudson.

No. 5—Jas. H. Lane farm.

	Thickness.	Depth.	Geological Formation.
Clay and sand	22	22	Devonian Shales.
Black shale	80	102	
Brown lime (gas and salt water)	10	112	Ragland Sand (Corniferous).
Soapstone	48	160	Niagara Shale.
Blue lime	15	175	Clinton.
Soapstone	5	180	
Blue lime	556	736	Hudson.
Brown lime	5	741	(Probably some Clinton at the top.)
Blue lime	66	807	

No. 6—Robert Rose farm.

	Thickness.	Depth.	Geological Formation.
Slate and gravel	13	13	Devonian Shales.
Black shale	87	100	
Gray flint lime (gas and salt water)	10	110	Ragland Sand (Corniferous).
Brown lime	10	120	
Soapstone	80	200	Niagara Shale.
Blue lime	595	795	Clinton and Hudson.
Gray lime	15	810	
Blue lime	70	880	

No. 7—O. M. Law farm.

	Thickness.	Depth.	Geological Formation.
Clay	12	12	Devonian Shales.
Black shale	138	150	
Flint lime	10	160	Ragland Sand (Corniferous).
Soapstone	40	200	Niagara Shale.
Hard, gray lime (oil trace)	3[2]	203[2]	Clinton.
Soapstone	10[2]	214	
Blue lime	292	506	Hudson. (Probably some Clinton at the top.)

No. 8—C. B. Skidmore farm, near Stanton.

	Thickness.	Depth.	Geological Formation.
Clay	25	25	
Soapstone	100	125	Waverly.
Hard, gray lime	2	127	Waverly.
Soapstone	10	137	Waverly.
Black shale	170	307	Devonian. (Corniferous missing.)
Soapstone	143	450	Niagara.
Hard, gray lime	25	475	Clinton (?)
Hard, blue lime	700	1,175	Hudson and Trenton.
Hard, brown lime	334	1,509	Hudson and Trenton.

No. 9—J. F. Martin, No. 3.

Clay	5	5	
Soapstone	270	275	Waverly.
Black shale	125	400	Devonian.
Gray lime (gas show)	24	424	Corniferous.
Soapstone	140	564	Niagara.
Brown lime	10	574	Probably all Clinton.
Soapstone	6	580	Probably all Clinton.
Gray lime	20	600	Probably all Clinton.
Blue lime	75	675	Hudson.
Soapstone	12	687	Hudson.
Blue lime	122	809	Hudson.

No. 10—Wm. Truett farm.

Clay	10	10	
Soapstone	90	100	Waverly.
Red Rock	15	115	Waverly.
Soapstone	45	160	Waverly.
Black shale	120	280	Devonian.
Soapstone	10	290	Devonian.
Gray lime	5	295	Corniferous.
Soapstone	115	410	Niagara.
Blue lime	10	420	Clinton and Hudson.
Soapstone	20	440	Clinton and Hudson.
Blue lime	10	450	Clinton and Hudson.
Soapstone	10	460	Clinton and Hudson.
Brown lime	5	465	Clinton and Hudson.
Blue lime	149	614	Clinton and Hudson.

No. 11—Wingate Anderson farm.

Clay	20	20	
Soapstone	30	50	Waverly.
Gray lime	5	55	Waverly.
Soapstone	35	90	Waverly.
Black shale (gas at 160)	135	225	Devonian. (Corniferous missing.)
Soapstone	35	260	Niagara.
Blue shale	105	365	Niagara.
Blue lime, oil show at 400, gas show at 1,200.	985	1,350	Clinton, Hudson and Trenton.
Brown lime	262	1,612	Birdseye and Chazy.

No. 12—J. F. Martin farm, No. 1.

	Thickness.	Depth.	Geological Formation.
Clay	10	10	
Soapstone	215	225	Waverly.
Black shale	125	350	Devonian.
Gray lime (gas)	24	374	Corniferous.
Soapstone	141	515	Niagara.
Brown lime	10	525	Clinton.
Soapstone	5	530	Clinton.
Gray lime (oil show)	20	550	Clinton.
Blue lime	60	610	Hudson.
Soapstone	15	625	Hudson.
Blue lime	150	775	Hudson.
Soapstone	10	785	Hudson.
Blue lime	29	814	Hudson.

ESTILL COUNTY WELLS.

West farm—Irvine field.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Clay	14	3	25	45	4	22
Black shale (Devonian)	49	69	50	17	91	52
Oil sand (Corniferous)	20	20	18	13	16	13
	83	92	93	75	111	87

No. 7—West farm.

	Thickness.	Depth.	Geological Formation.
Clay	45	45	
Black shale	24	69	Devonian Shale.
Hard, gray lime	25	94	Corniferous L. S.—Estill sand (Ragland sand).
Light, gray lime	36	130	Corniferous L. S.—Estill sand (Ragland sand).
Gray soapstone	145	275	Niagara Shale.
Hard, gray lime	30	305	Clinton.
Soapstone	10	315	Clinton.
Gray lime	8	323	Clinton.
Red lime	10	333	Clinton.
Bastard, gray lime	17	350	Lower Silurian (Ordovician) Limestones.
Bastard, brown lime	40	390	Lower Silurian (Ordovician) Limestones.
Bastard, gray lime	839	1,229	Hudson and Trenton Groups.

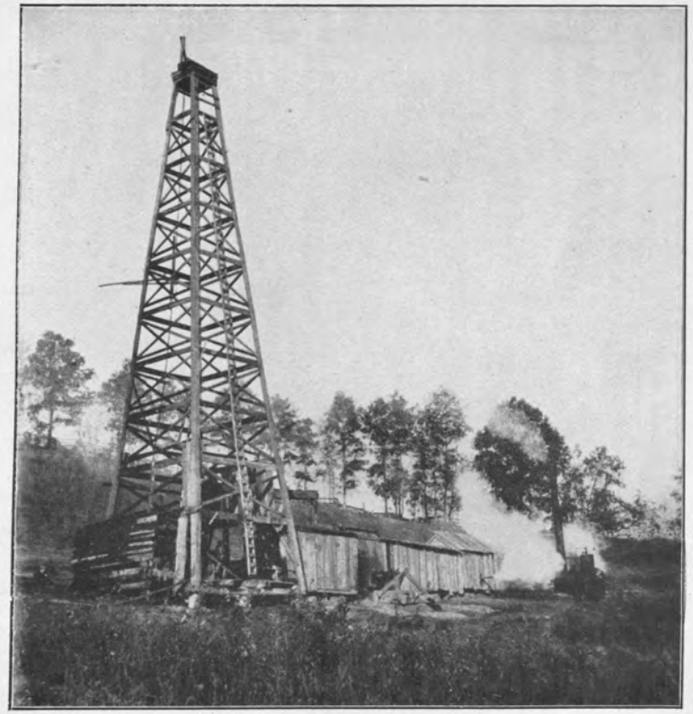
Of the above records, the first six were taken at random from a number of records of wells drilled into the oil-sand. The seventh was drilled deeper; it shows an unusual thickness of Corniferous (the limestones on outcrop about a mile west are only 25 to 30 feet thick), and also shows 145 feet of Niagara shales under the oil-sand. The thirty feet of limestones under the Niagara shale are nearly all Clinton, but the upper layers may belong to the Niagara. The well went probably 250 feet in the Trenton rocks, or about to the top of the Birdseye.

A combined section made from the log of the above well (No. 7), the log of a well now being drilled on White Oak creek, and a detailed section of the St. Louis, etc., given in volume 4 of the Owen reports, would show the rocks from near the top of the Conglomerate measures down to probably within 100 feet of the base of the Chazy limestones. The well on White Oak started near the top of the Black Shale and is down over 1,900 feet.* The record was not kept in the upper part, but begins at 1,260 feet, which would be just about where the record of No. 7 ends. The following is the section combined as above:

COMBINED SECTION IN ESTILL COUNTY.

	Thickness.	Depth.	Geological Formation.
Heavy sandstone	196	2,788	Conglomerate Measures, 271.
Shales and shaly sandstone	50	2,592	
Black slate	4	2,542	
Coal	1	2,538	
Gray shales	4	2,537	
Coal	1	2,533	
Shales	15	2,532	
Buff, earthy limestones	8	2,517	Chester, 33.
Archimedes limestone	2	2,509	
Gray limestone	13	2,507	
Calcareous shales	10	2,494	
Oolitic limestone	10	2,484	St. Louis, 150.
Buff limestone	11	2,474	
Semi-oolitic limestone	22	2,463	
Gray limestones	12	2,441	
Earthy, buff limestone	5	2,429	
Thin, gray, cherty limestones	24	2,424	
Massive limestone	22	2,400	
Blue limestone and shales	38	2,378	
Earthy, yellow limestone	6	2,340	
Sandstones and shales	490	2,334	Waverly, 490.
Black shale	125	1,844	Devonian Shales, 125.
Estill County oil sand	about 25	1,719	Corniferous, 25.
Blue and gray shales	145	1,694	Niagara, 150.
Gray lime	about 5	1,549	
Gray lime	25	1,544	Clinton, 53.
Gray shale	10	1,519	
Gray lime	8	1,509	
Red lime	10	1,501	
Gray lime	17	1,491	Lower Silurian. (Ordovician). Hudson and Trenton Groups, 1476.
Brown lime	40	1,474	
Gray lime	839	1,434	
Greenish-white, friable, shaly sandstone	about 10	595	
Hard, fine-grained limestone, dark dove color, with occasional bands of dark-blue, hard limestone	425	585	
Hard, gray limestone	145	160	
White, fine-grained sand and lime mixed	15	15	Calciferous.
Bottom of White Oak well	0	0	

*This well has since been drilled deeper, striking high pressure gas in the Calciferous, at about 1,940 feet.



No. 8. Boyd well at Campton, Wolfe County. (Showing a Standard Rig.)

The first fifteen feet are Calciferous; the next 570 feet Chazy and Birdseye, with about ten feet of fine, light green sand marking the top of the latter. Of the 839 feet of limestones above that, the lowest 200 to 250 feet constitute the Trenton limestones, and the rest, up to about 1,500, belong to the Hudson.

BREATHITT COUNTY WELL.

Frozen Creek.

	Thickness.	Depth.
Clay	12	12
White sand	53	65
Porous, bastard lime (?)	2	67
White sand	73	140

The well is all in the Conglomerate and gave a strong show of black oil in the two feet of "bastard lime."

WOLFE COUNTY WELL.

Well at Campton.	Thick-ness.	Depth.
Conglomerate. (White sands and slates)	420	420
St. Louis L. S.	110	530
Waverly. (Blue and white shales)	498	1,028
Devonian black shale	191	1,219
Niagara. (Blue shale)	31	1,250
Clinton L. S. (Oil sand)	16	1,266

(No mention is made of the Berea Grit, although it must have been passed through.)

The above geological divisions are as reported on the record sent in. A record of a well drilled since, accompanied by samples of the drillings from the lower part of the well, shows, under the Black Shale and at the place of the shales called "Niagara," about 16 feet of light-colored shale, then 12 feet of *black* shale and then the oil rock, the latter strongly resembling the Ragland of Bath county. The 12 feet of black shale directly over the oil-rock, makes it probable that the latter is the Corniferous and not Clinton.

MAGOFFIN COUNTY WELL.

Near Hendricks P. O.

	Thickness.	Depth.	Geological Formation.
Drift	40	40	
Black slate	260	300	
Gray sand	85	385	
Black slate	75	460	Coal Measures and Conglomerate.
Shelly slate	25	485	
White lime	40	525	
White sand	190	715	
Gray lime	210	925	St. Louis L. S.
Black slate	245	1,170	
Shelly sand	20	1,190	Waverly.
Bastard, gray sand	100	1,290	
Shelly slate	100	1,390	
Black slate	400	1,790	Devonian Shale.
Lime	290	2,080	
Bastard, gray sand	50	2,130	Upper and Lower Silurian Limestones.
Slate and red shale	77	2,207	

There is no Niagara Shale reported in this record and nothing by which to distinguish the possible Devonian and Upper Silurian limestones contained in the upper part of the 290 feet of limestone next below the Black Shale. The last two members are evidently Hudson.

MORGAN COUNTY WELL.

This well, drilled on Caney creek just below the town of Caney, will give, not only the section for that immediate locality, but a typical record for Morgan county. The record was very carefully kept by Mr. G. M. Sullivan, and all formations noted, giving an accurate record or geological section from the lower part of the Coal Measures down nearly to the Trenton.

Caney Creek Well.

	Thickness.	Depth.	Geological Formation.
Drift	15	15	
Shale	10	25	Base of Coal Measures.
Sand (gas at 75, 125 and 200)	235	260	
Pebble rock	5	265	
Sand	40	305	
Pebble rock	13	318	
Dark shale and sand	12	330	
Dark shale	10	340	Conglomerate Measures.
Shaly sand	5	345	
Sand	35	380	
Pebble rock	30	410	
Coal	1	411	
Dark shale	42	453	

	Thickness.	Depth.	Geological Formation.
Limestone	15	468	
Limy shale	5	473	St. Louis L. S.
Limestone	52	525	
Sand and shale (oil at 625)	235	760	
Limy shale	5	765	
Red sand	1	766	
Dark-blue, sandy shale (gas at 850, 865 and 920)	154	920	
Hard, fine sand	5	925	
Shale	5	930	
Fine sand (salt water)	2	932	
Coarse sand	8	940	Waverly and Berea.
Dark shale	33	973	
Sand	2	975	
Dark shale	37	1,012	
Shale and sand	16	1,028	
Very black shale	7 (Berea Sh.)	1,035	
Sand (oil at 1,052)	24 (Berea Grit)	1,059	
Dark shale and sand	28	1,087	
Black shale (gas and oil at 1,145)	283	1,370	Devonian Black Shale, with a little Corniferous L. S. at the base.
Soft, blue shale	30	1,400	Niagara Shale.
Sandy lime (Clinton sand at 1,408)	50	1,450	Clinton.
(Oil and gas at 1,408. Salt water at 1,416.			
Lime	65	1,515	
Lime and sand	15 (Caney sand)	1,530	
(Oil and gas at 1,525).			
Lime	87	1,617	
Sand	10	1,627	
Blue and dark, sandy lime	25	1,652	
Red shale	133	1,785	
Blue shale	79	1,864	
Hard lime	5	1,869	
Blue, clay shale	22	1,891	
Hard, gray lime	9	1,900	
Red shale	6	1,906	Hudson.
Blue shale and lime	12	1,918	
Red shale	4	1,922	
Dark-blue shale	20	1,942	
Dark-gray lime	25	1,967	
Sand	7	1,974	
Blue, sandy and limy shale	4	1,978	
Hard, sandy lime	7	1,985	
Sandy and limy shale	4	1,989	
Dark-blue, lime shale	32	2,021	

Probably stopped just short of the top of the Trenton.

CARTER COUNTY WELL.

Guffey Well, near Grayson.

	Thickness.	Depth.	Geological Formation.	
Quicksand	28	28	Conglomerate Measures.	
Black slate	30	58		
Sandstone	12	70		
Black slate	10	80		
Limestone	20	100	St. Louis.	
Dark green, sandy shale	230	330		Waverly.
Light gray slate and sand shells.	270	600		
Sandstone and shale	50	650		
Sandstone, slate and shells	85	735		
Black slate	22	757	Berea Shale.	
Berea sand (oil and gas)	112	869	Berea Grit.	
Gray slate	25	894	Bedford.	
Red slate	6	900		
Black slate	116	1,016	Devonian Shales.	
White slate	5	1,021		
Black slate	169	1,190		
White slate	20	1,210		
Black slate	95	1,305		
White slate	118	1,423		
Limestone (oil and gas)	2	1,425	Corniferous.	
Limestones, fine and coarse	55	1,480	Upper Silurian limestones (Niagara and Helderburg).	

Strong flow of salt water at 1,475.

This record was kept by a trained observer and is not only accurate, but gives a typical section of the Carter county rocks from just below the Coal Measures down to about the top of the Niagara Shale. This well was drilled just north of Grayson and in a synclinal basin, this latter accounting for the strong flow of salt water.

WELL AT CINCINNATI.

At 280, a dark-gray, crystalline limestone.
At 290, a bed of gray and white sand.
At 305, a mottled, light, crystalline limestone and a dark, limy shale. (Can not tell which belongs above the other.)
At 334, 344 and 385, gray, limy shales.
At 450 and 505, lighter gray, lime shales.
At 575 and 610, light gray, lime shales.
At 640, darker, lime shales.
At 675, soft, white, shaly limestone.
At 775, soft, very porous, white, lime shales.
From 815 to 1,330, fine-grained, white, sandy limestone.

This record is taken from an incomplete set of drillings. The well started a little above the top of the Trenton, the specimen at 280 being from the bottom part of the upper Trenton rocks. The shales and shaly limestones are different from records for the same part of the geological section elsewhere, taking the place of the Chazy limestones. The last 515 feet (from 815 to 1,330) represents the Calciferous, the next formation below the Trenton group, and the basal member of the Lower Silurian.

PORTSMOUTH AND IRONTON, OHIO, WELLS.

The two following records are given in order to show the section on the Ohio river in the northeastern part of the State. They are taken from volume 6 of the Ohio reports:

Portsmouth Well.

	Thickness.	Depth.	
Waverly	120	120	
Berea shale	30	150	
Berea grit	50	200	
Bedford shale	50	250	
Devonian shales	560	810	
Upper Silurian limestones	675	1,485	Helderburg, Niagara, Clinton.
Medina	50	1,535	
Hudson	465	2,000	

Ironton Well.

	Thickness.	Depth.
Coal measures	282	282
Conglomerate and Logan Group	300	582
Blue shale	30	612
Sandstone	30	642
Cuyahoga shales	348	990
Berea shale	20	1,010
Berea grit	47	1,057
Bedford shale and sand	90	1,147
Ohio Shales (Devonian)	680	1,827
Corniferous and Upper Silurian limestones	584	2,411
Upper Silurian and Hudson shale and limestone	1,031	3,442
Top of Trenton at	3,442	
Bottom of well at	3,660	

In these records, no mention is made of the Niagara Shale, they agreeing with records of wells in Northeastern and Eastern Kentucky, showing it thinned out just east of the deep trough of shale mentioned above on page 37, and replaced by the Niagara limestones.

BOYD COUNTY WELLS.

No. 1—Well near Summit Station.

	Thickness.	Depth.
Coal Measures and Conglomerate	675	675
St. Louis limestone	60	735
Waverly sands and shales	590	1,325
Berea shale	20	1,345
Berea grit	13	1,358
Bedford shale	57	1,415

The well started fifty-two feet above Coal No. 6 and stopped just above the Devonian black shale. Shows of oil and gas and salt water were struck in the Waverly sands, and gas and green oil in the Berea Grit.

No. 2—Longabaugh Well four miles south of Ashland.

	Thickness.	Depth.	Geological Formation.
Clay	14	14	Coal Measures and Conglomerate.
Slate	10	24	
White sand	38	62	
Slate	28	90	
Dark sand	20	110	
White sand	28	138	
Slate	38	176	
Sand	20	196	
Black slate	110	306	
Gray sand (salt water)	35	341	
White sand	48	389	
Slate	15	404	
Gray sand	20	424	
Slate	15	439	
White sand (salt water)	31	470	
Black sand	5	475	
White sand (salt water)	25	500	
Limestone	50	550	St. Louis Limestone.
Shales and sands (salt water at 698)	532	1,082	Waverly.

Some oil was reported. The well probably stopped in the Berea Grit.

LAWRENCE COUNTY WELLS.

No. 1—Broas Well on Hood Creek.

	Thickness.	Depth.	Geological Formation.
Soil	18	18	Conglomerate Measures.
Sand	14	32	
Clay	7	39	
Sand	78[2]	117[2]	
Shale	52	169[2]	
Sand	50	219[2]	
Coal	2	221[2]	
Slate	12	233[2]	
Limestone	103[2]	337	Chester and St. Louis.
Sand	27[2]	364	
Limestone (oil at 320)	26	390	
Slate and shale	384	774	Waverly.
Sand	100	874	Berea (?)
Black shale	580	1,454	Devonian.
Sand	16	1,470	
Limestone	145	1,615	

Some oil in St. Louis.

No. 2—F. F. Well on Big Blaine Creek.

	Thickness.	
Soil	12	All Conglomerate Measures.
Fire clay	6	
Gray sand	32	
Black shale	94	
White sand	24	
Black shale	3	
Dark sand	21	
Gray sand and pebbles	7	
White sand	21	
Coarse pebbles (oil show)	12	
White, coarse sand (oil show)	44[2]	
Sand and shale	25	
Coarse, white sand and pebbles (oil, gas)	25[2]	
Honey-comb rock	40[2]	
	367[2]	

Lubricating oil in last member.

No. 3—Griffiths Creek.

	Thickness.	Depth.	Geological Formation.
Sands and shales	790	790	Coal Measures and Conglomerate.
Limestone	152	942	St. Louis.
Blue shale (oil at 1,423)	481	1,423	Waverly.
Gray sand (oil at 1,510)	87	1,510	Berea.
?	20	1,530	
Hard shales	4	1,534	
Black shale and lime shells	644	2,178	Devonian Shales.
Limestone (oil)	3	2,181	
Blue shale (gas at 2,211)	30	2,211	
Green shale (gas at 2,350)	158	2,369	
Black and blue shales	38	2,407	

No. 4—Horsford Well, 1½ miles above mouth of Big Blaine.

	Thickness.	Depth.
Coal Measures and Conglomerate.	1,025	1,025
St. Louis	140	1,165
Waverly	535	1,700
Berea shale	27	1,727
Berea grit (gas)	60	1,787
Black shale	53	1,840

Gas in Berea grit. Stopped at 1,840 in top of Devonian shales.

No. 5—Mouth of Big Blaine.

	Thickness.	Depth.	Geological Formation.
Soil	20	20	Coal Measures.
Yellow sand	15	35	
White sand	45	80	
Gray shale and red rock	35	115	
Gray sand	25	140	
White sand	170	310	
Brown shale	45	355	
Gray sand	60	415	
Black slate	15	430	
White sand	110	540	Conglomerate Measures. (No St. Louis shown.)
Gray shale	50	590	
Black shale	20	610	
Gray sand (gas and salt water)	125	735	
Black slate	30	765	
White sand (gas and salt water)	95	860	
Black shale	10	870	
White, conglomerate sand	365	1,235	
Green sand	5	1,240	Waverly, including place for St. Louis. The 5 feet of green sand is probably part of Chester and the 2 foot gas sand part of the Berea Grit under 10 feet of Berea Shale.
Gray, slate shells	410	1,650	
Black slate (Berea shale)	10	1,660	
White sand (Berea grit), gas	2	1,662	
Sand, lime and shells	15	1,677	
Sand and shale	65	1,742	
Black slate	5	1,747	Devonian Shales.
Sand and shells	5	1,752	
Bluish-black slate	648	2,400	
Light gray slate	192	2,592	
Limestone	5	2,597	Corniferous.

This record shows four heavy sands in the Conglomerate measures, which correspond approximately to the sands of Floyd, Pike and Martin counties.

No. 6—Berry Well, on Hood Creek.

	Thickness.	Depth.	Geological Formation.
Soil	20	20	Conglomerate Measures.
Shale	82	102	
Hard sand	25	127	
Fine sand and shale	14	141	
Dark sand	10	151	
Shale	9	160	
Gray sand	63	223	
Clay shale	4	227	
Gray sand	36	263	
White sand	137	400	
Shale	95	495	
Lime	152	647	St. Louis.
———	195	842	
Gray sand	48	890	Berea Grit (?)
Blue shale	15	905	
Black shale	195	1,100	Probably all Devonian.
Sand and shale	515	1,615	
Sand and blue shale	105	1,720	
Lime and sand (oil and gas)	20	1,740	
White lime	80	1,820	
Lime and sand	65	1,885	
Hard, reddish sand	27	1,912	
Yellow sand (oil)	3	1,915	
Hard, reddish, speckled sand	2	1,917	
Dark sand (oil)	28	1,945	
Lime	160	2,105	

JOHNSON COUNTY WELLS.

No. 1—Well on Tom's Creek—Van Hoose farm.

	Thickness.	Depth.	Geological Formation.
Black slate	185	185	Coal Measures and Conglomerate Measures.
Brown sand	20	205	
White slate	30	235	
Gray sand	130	365	
White slate	42	407	
White sand	265	672	
White lime	150	822	St. Louis.
Dark sand	100	922	Place of Big Injun Sand.
White slate	244	1,166	..... Waverly.
Gray sand	75	1,241	Place of Berea Grit.
Hard, slate shell	56	1,297	
Black shale	500	1,797	Devonian Shales.
White slate	143	1,940	
Black shale	13	1,953	
Gray lime	15	1,968	Clinton (?)
Gray lime to bottom		2,006	

The well started in the base of the Coal Measures and shows two heavy sands (at 235-365 and 407-672) in the Conglomerate Measures.

Samples of drillings showed the lime at 1,953 to be Clinton.

No. 2—J. C. Murphy farm.

	Thickness.	Depth.	Geological Formation.
Sand and gravel	30	30	Conglomerate Measures.
Black slate	50	80	
White sand	80	160	
Black slate	5	165	
White sand	370	535	
White lime	158	693	St. Louis.
Black slate and shale	150	843	Waverly.
White slate	209	1,052	
Gray sand	73	1,125	Place of Berea Grit.
White slate and shell	50	1,175	
Black shale	450	1,625	Devonian Shales.
White slate	155	1,780	
White lime	90	1,870	
Dark lime	92	1,962	

MARTIN COUNTY WELLS.

No. 1—Jack Cassidy farm—Hardin Br. of Coldwater Fork of Rockcastle Cr.

	Thickness.	Depth.	Geological Formation.
Drift	24	24	
Gray sand	88	112	
Light slate	12	124	
White sand	18	142	
Light slate	40	182	
Gray sand	3	185	
Black slate	5	190	
Gray sand	76	266	
Black slate	8	274	
Gray sand	13	287	
Light slate	30	317	
Black slate	87	404	
Very dark sand (gas)	15	419	Stray Gas Sand.
Black slate	56	475	
White sand (salt water)	93	568	Beaver Sand.
Black slate	5	573	
Gray and white sands	69	642	Horton Sand.
Black slate	7	649	
Gray sand	60	709	Stray Sand.
Black slate	2	711	
Gray sand	24	735	
Black slate	3	738	
White sand	102	840	Pike Sand.
Dark gray sand	4	844	
White sand	58	902	
Black slate	53	955	
Dark gray sand	4	959	
Dark slate	33	992	
Limy sand	6	998	
Light slate	4	1,002	
White sand (gas)	14	1,016	Salt Sand.
Light slate	34	1,050	Base of Conglomerate Measures.
Dark lime	8	1,058	Chester Group (Mauch Chunk).
Red shale	53	1,111	
Light slate	8	1,119	
White sand	26	1,145	
White lime	15	1,160	
Black slate	30	1,190	

	Thickness.	Depth.	Geological Formation.
Dark lime (gas at 1,340)	200	1,390	St. Louis—(Gas).
Sandy slate	12	1,402	Big Injun.
Red shale	27	1,429	Logan Shale.
Dark slate	445	1,874	Pocono Slate.
Very black slate	18	1,892	Berea Shale.
Gray, limy sand	27	1,919	Berea Grit.
Light slate	20	1,939	Devonian Shales.
Dark slate	32	1,971	
Brown slate	10	1,981	
Dark slate	24	2,005	

This well shows six sands in the Conglomerate Measures, and also gave a strong flow of gas at 1,340, in the St. Louis. The Big Injun is only represented by 12 feet of sandy shale.

No. 2—Warfield Well.

	Thickness.	Depth.	Geological Formation.
Soil	32	32	
Space	11	43	
Coal	7	50	
Gray sand	97	147	
Coal	3	150	Probable Top of Conglomerate Measures.
White sand	50	200	
Shale (salt water)	75	275	
Sand	20	295	
Shale	214	509	
Sugar sand	71	580	
Smut seam	1	581	
Space	12	593	
Sand (oil show)	88	681	
Shale	18	699	
Sand	51	750	
Shale	200	950	
Pebbly sand (oil, gas)	50	1,000	Base of Conglomerate Measures.
White and blue shale	200	1,200	May represent the Mauch Chunk Shales.
Coarse, pebbly sand	10	1,210	May be Mt. Lime and Big Injun—broken.
Shells	90	1,300	
Sandy lime (gas)	7	1,307	Heavy gas flow.

No. 3—Burning Well—across the river from the Warfield Well.

Soil	26	26	
Light slate	46	72	
White sand	44	116	
Coal	5	121	
Light slate	80	201	
White sand	18	219	
Black slate	20	239	
White sand	20	259	Conglomerate Measures (top uncertain.)
Light, shelly slate	57	316	
Black slate	50	366	
Light, shelly slate	75	441	

	Thickness.	Depth.	Geological Formation.
White sand	130	571	Gas, Oil and Salt Water.
Light slate	15	586	
White sand	46	632	Gas and Salt Water.
White slate	20	652	
White sand	112	764	Gas and Salt Water.
Shelly slate	55	819	Base of Conglomerate Measures.
Red shale	30	849	
Light slate	5	854	
Red shale	25	879	
Light slate	15	894	
Hard sand	18	912	
Red shale	10	922	
White sand	24	946	Chester Group (Mauch Chunk).
Red shale	4	950	
Light slate	22	972	
Lime	4	976	
Slate	10	986	
Red shale	2	988	
Shelly slate	20	1,008	
Dark sand	30	1,038	
Lime	162	1,200	St. Louis—Gas in the limestone at 1,098.
Slate and sand shells	138	1,338	Big Injun Group—Gas in sand shells at 1,202 and 1,315.

Well has three sands in Conglomerate Measures. Gave gas from both St. Louis and Big Injun.

No. 4—Sam. Munsey farm—Big Branch of Wolf Creek.

	Thickneess.	Depth.	Geological Formation.
Drift	56	56	
Light slate	24	80	
Gray sand	35	115	
Light slate	23	138	
Dark gray sand	37	175	
Dark slate	18	193	
Coal	2²	195	
Dark slate	15	210	
Coal	4	214	
Sandy slate	8	222	
Shelly slate	240	462	Coal Measures and Conglomerate.
Light sand	16	478	
Shelly slate	167	645	
Gray sand	45	690	
Dark slate	8	698	
Gray sand	87	785	
White sand	48	833	
Coal	3²	836	
Dark gray sand	29	865	
Dark gray slate	28	893	
White sand (black oil)	79	972	
Shelly slate	38	1,010	Base of Conglomerate Measures.

	Thickness.	Depth.	Geological Formation.
Red shale	15	1,025	
Black sand	14	1,039	
Black slate	6	1,045	
Red shale	10	1,055	
Black slate	18	1,073	Chester Group (Mauch Chunk).
Red shale	78	1,151	
Dark gray sand (gas)	12	1,163	
Dark gray slate	30	1,193	
Gray sand	36	1,229	
Black slate	6	1,235	
Dark lime	20	1,255	St. Louis.
White lime	155	1,410	
Dark gray sand	16	1,420	Big Injun Group.
Sandy slate	16	1,436	
Black slate	6	1,442	
Dark sand	15	1,457	
Dark slate	78	1,535	Pocono Slate.
Black slate	4	1,539	

This well only shows two sands in the Conglomerate measures, with the anomaly of a strong gas flow from a sand in the Chester group. The Mountain Lime and Big Injun were both unproductive.

No. 5—J. M. Stepp farm—Wolf Creek.

	Thickness.	Depth.	Geological Formation.
Drift	18	18	
Sand	12	30	
Coal	2²	32	
Slate	12	44	
Dark sand	15	59	
White sand	40	99	
Light slate	10	109	
White sand	40	149	
Light slate	5	154	
White sand	56	210	
Coal	2²	212	
Light slate	105	317	
Gray sand	8	325	
Coal	2²	327	
White sand	10	337	
Light slate	20	357	
White sand	12	369	
Black slate	20	389	Coal Measures and Conglomerate.
White slate	40	429	
White sand	21	450	
Light slate	50	500	
White sand	24	524	
Black slate	25	549	(Upper part of Conglomerate Measures badly broken. Three sands at 810, 919 and 984, respectively.)
White sand	30	579	
Light slate	24	603	
Gray sand	24	627	
Light slate	25	652	
White sand	13	665	
Gray sand	35	700	
Dark slate	40	740	

	Thickness.	Depth.	Geological Formation.
White sand	15	755	
Sandy slate	20	775	
Gray sand	25	800	
Black slate	10	810	
White sand	100	910	
Coal	3	913	
Light slate	6	919	
White sand	24	943	
Gray sand	13	956	
Dark slate	14	970	
Light slate	14	984	
White sand	19	1,003	
Yellow sand	56	1,059	
White sand	64	1,123	
Black slate	20	1,143	Base of Conglomerate Measures.
Red shale	6	1,149	Chester Group (Mauch Chunk).
Light sand	100	1,249	
Dark slate	18	1,267	
Red shale	36	1,303	
Blue lime (oil show)	40	1,343	St. Louis, with oil at 1,320 and gas at 1,400.
White lime (gas)	177	1,520	
Blue slate	33	1,553	Big Injun Slate.

FLOYD COUNTY WELLS.

No. 1—R. Allen farm.—Head of Sugar Camp Br. of Right Beaver.

	Thickness.	Depth.	Geological Formation.
Drift	34	34	
Slate	11	45	
Gray sand	15	60	
Slate	55	115	All Coal Measures and Conglomerate.
Gray sand	34	149	
Slate	9	158	
Gray sand	32	190	
Black slate	24	214	
Gray sand	16	230	
Black slate	4	234	
Gray sand	11	245	
Black slate	35	280	
Coal	2[2]	282	
Black slate	38	320	Probable top of Conglomerate Measures.
Gray sand	68	388	
Black slate	27	415	
Gray sand	20	435	
Black slate	41	476	
Gray sand	54	530	
Black slate	38	568	
Coal	2[2]	570	
Black slate	60	630	
Sand (salt water)	198	828	Beaver Sand.
Coal	1[2]	829	
Dark slate	40	869	
Gray sand	46	915	Horton Sand.
White sand	47	962	
Gray sand	22	984	

	Thickness.	Depth.	Geological Formation.
Dark slate	24	1,008	
Dark gray sand	8	1,016	
Dark slate	40	1,056	
Gray sand	7	1,063	Pike Sand.
White sand	35	1,098	
Gray sand	17	1,115	
White sand	39	1,154	
Dark slate	32	1,186	
Gray and white sands (gas, oil, salt water)	50	1,236	Salt Sand.

The well is all in Coal Measure and Conglomerate rocks. A section of the hill, a short distance up the creek from the well, gives the No. 1 coal about 30 feet above the creek; this will connect the well section with the section of the Coal Measures above ground.

No. 2—Geo. Allen farm—Right Beaver.

	Thickness.	Depth.	Formation.
Conductor	23	23	
Slate	17	40	
Coal	2[2]	42	All Coal Measures and Conglomerate.
Gray sand	38	80	
Slate	50	130	
Gray sand	22	152	
Slate	107	259	
Gray sand	61	320	
Slate	80	400	
Sand	52	452	
Slate	90	542	
White sand	132	674	Beaver Sand.
Slate	7	681	
White sand (gas)	94	775	Horton Sand.
Gray sand	27	802	
White sand (salt water)	98	900	
Gray sand	17	917	
Black slate	75	992	
Black, gray and white sands	9	1,001	
Black slate	7	1,008	Pike Sand.
White sand (oil)	70	1,078	
Slate	½		
Sand	14[2]	1,093	
Slate	47	1,140	Salt Sand.
Sand			

No. 3—Newt. Allen farm—Right Beaver above Wilson Creek.

	Thickness.	Depth.	Geological Formation.
Conductor	45	45	
Slate	85	130	
Gray sand (gas)	31	161	
Slate	50	211	All Coal Measures and Conglomerate.
Gray sand	12	223	
Slate	53	276	
Gray sand	19	295	
Slate	74	369	
White sand	166	535	Beaver Sand.
Slate	8	543	
White sand (salt water)	205	748	Horton Sand.
Coal	2[2]	750	
Gray sand	18	768	
Dark slate	28	796	
Yellow slate	5	801	
Gray and white sands (gas)	56	857	Pike Sand.
Black slate	13	870	
White sand	15	885	Salt Sand.

No. 4—Mary Estep farm—Right Beaver.

Drift	58	58	All Coal Measures and Conglomerate.
Slate	40	98	
Sand	21	119	
Slate	81	200	
Sand	29	229	
Slate	10	239	
Sand	14	253	
Slate	69	322	
Sand	20	342	
Slate	98	440	
Sand (gas)	118	558	Beaver Sand.
Slate	2	560	
Sand (salt water)	112	672	
Slate	30	702	
Sand (gas, salt water)	67	769	Horton Sand.
Slate	19	788	
Shelly slate	52	840	
Gray sand	44	884	Pike Sand.
Dark sand	9	893	
White sand (gas, oil)	87	980	
Slate	14	994	
Light sand	26	1,020	
Slate	23	1,043	
Sand (oil and salt water)	56	1,099	Salt Sand.

No. 5—John Martin farm—Right Beaver.

	Thickness.	Depth.	Geological Formation.
Drift	25	25	
Slate	25	50	All Coal Measures and Conglomerate.
Coal	3[2]	53	
Slate	17	70	
Sand	51	121	
Slate	34	155	
Sand	55	210	
Slate	2	212	
Sand	29	241	
Slate	194	435	
Sand (gas)	219	654	Beaver Sand.
Coal	2[2]	656	
Slate	19	685	
Sand	105	790	Horton Sand.
Slate	3	793	
Sand	31	824	
Slate	3	827	
Sand	35	862	
Slate	35	897	
Sand (oil)	56	953	Pike Sand.
Slate	34	987	
Sand	10	997	
Slate	5	1,002	
Sand	18	1,020	
Slate	29	1,049	
Sand	67	1,116	Salt Sand.

The record is all in Coal measures and Conglomerate and shows the latter broken by additional beds of slate and sand coming in.

No. 6—John Martin farm.

	Thickness.	Depth.	Geological Formation.
Soil	40	40	
Dark sand	15	55	
Coal	5	60	
Black slate	35	95	
Gray sand	15	110	All Coal Measures and Conglomerate.
White slate	67	177	
White sand	27	204	
Black slate	8	212	
Gray sand	43	255	
Black slate	57	312	
Dark sand	20	332	
Black slate	107	439	
Gray sand	231	670	Beaver Sand.
Black slate	6	676	
White sand	6	682	
Black slate	30	712	
White sand (salt water)	137	849	Horton Sand.
Dark sand	10	859	
Gray sand	23	882	
Black slate	30	912	
Gray sand (oil)	84	996	Pike Sand.
White slate	4	1,000	
White sand (oil)	36	1,036	
Black slate	8	1,044	
White sand (oil)	43	1,087	Salt Sand.

No. 7—Estep farm—One and one-half miles below mouth of Jones' Fork of Right Beaver.

	Thickness.	Depth.	Geological Formation.
Soil	37	37	
Slate	123	160	All Coal Measures and Conglomerate.
Sand	102	262	
Dark slate	173	435	
Gray sand	10	445	Beaver Sand.
White sand	236	681	
Coal	2	683	
Gray sand	8	691	
Slate	25	716	
White sand	149	865	Horton Sand.
Dark gray sand	10	875	
Dark slate	45	920	
White sand	44	964	
Sand and slate	36	994	Pike Sand.
White sand	43	1,036	
Dark slate	18	1,054	
White sand	26	1,080	Salt Sand.

No. 8—Mouth of Salt Lick.

Soil	34	34	
Black slate	10	44	
White sand	50	94	
Black slate	30	124	All Coal Measures and Conglomerate to 1,130.
Gray sand	100	224	
Light slate	76	300	
White sand	20	320	
Light slate	130	450	
White sand (oil, gas, salt water)	212	662	Beaver Sand.
Black slate	30	692	
White sand (salt water)	108	800	Horton Sand.
Coal	1[2]	801[2]	
Black sand	12[2]	814	
Dark sand	30	844	
Black slate	59	903	
White and gray sand (gas and oil)	93	996	Pike Sand.
Very black slate	60	1,056	
White and gray sand (salt water)	50	1,106	Salt Sand.
Black slate	11	1,117	Base of Conglomerate Measures.
Dark lime	13	1,130	
Slate and lime shells	35	1,165	
Lime and slate	8	1,173	Chester Group.
Slate and lime shells	19	1,192	
Lime (oil and gas at 1,269)	138	1,330	St. Louis Limestone.
Red shale	95	1,425	May correspond to Logan Shale.
Slate and sand shells	181	1,606	
Black slate	44	1,650	
Light-blue slate and sand shells	130	1,780	Waverly (Pocono).
Very black slate	200	1,980	
Slaty lime (gas)	2	1,982	
Black slate (gas)	225	2,207	Devonian Shales.
Soft, light slate	33	2,240	

No. 9—Reffit farm—Pitt's Fork of Middle Creek.

	Thickness.	Depth.	Geological Formation.
Soil	22	22	
Light slate	28	50	Coal Measures and Conglomerate to 1,171
Gray sand	20	70	
Black slate	30	100	
White sand	70	170	
Black slate	8	178	
Gray sand	82	260	
Black slate	65	325	
White sand	58	383	
Light slate	17	400	
Gray sand	28	428	
Dark slate	22	450	
Gray sand	18	468	
Black slate	78	546	
White sand	10	556	
Black slate	8	564	
Very dark slate	35	599	
White sand	16	615	
Dark slate	49	664	
White sand (salt water)	142	806	Beaver Sand.
Black slate	5	811	
Very dark sand	25	836	Horton Sand.
White sand (salt water)	34	870	
Black slate	17	887	
Black sand	8	895	
Black slate	25	920	
Gray sand, pebbly at base (gas, oil and salt water)	235	1,155	Pike and Salt Sands.
Black slate	16	1,171	Base of Conglomerate Measures.
Sub. Carb. limestone	201	1,372	St. Louis L. S.
Red shale	38	1,410	Logan Shale.
Black slate	85	1,495	
White and shelly slate	100	1,595	Waverly (Pocono).
Dark slate	95	1,690	
White and shelly slate	60	1,760	
Brown slate	96	1,856	
White slate	12	1,868	Devonian Shales.
Brown slate	268	2,136	
Black slate (gas)	15	2,141	

Base of Conglomerate at 1,171. Chester either missing or included in the 201 feet of Sub. Carb. L. S. Bottom of well in Devonian.

No. 10—Middle Creek, near Prestonsburg.

	Thickness.	Depth.	Geological Formation.
Drift	61	61	
White sand	5	66	Coal Measures and Conglomerate to 851.
Light slate	34	100	
Gray sand	4	104	
Light slate	36	140	
Gray sand	50	190	
Black slate	5	195	
Gray sand	65	260	
Light slate	121	381	

	Thickness.	Depth.	Geological Formation.
White sand	175	556	Beaver Sand.
Coal	4	560	
Gray sand	15.	575	
Dark slate	15	590	
White sand	114	704	Horton Sand.
Black slate	8	712	
Dark sand	12	724	Pike Sand.
White sand (salt water)	15	739	
Very dark sand	25	764	
Black slate (gas and oil show)	25	789	
White sand (gas and salt water)	62	851	Salt Sand.
Black lime	25	876	Chester Lime.
White lime	39	915	Part of Chester, or possibly top of St. Louis.

No. 11—Dan. Howard farm—Right Beaver.

Soil	20	20	
Slate	6	26	
Gray sand	12	38	
Sandy slate	27	65	All Coal Measures and Conglomerate.
Light sand	33	98	
Light slate	67	165	
Gray sand	43	208	
Light slate	22	230	
White sand	20	250	
Black slate	50	300	
White sand	40	340	
Black slate	60	400	
Gray sand (gas and salt water)	25	425	Beaver Sand.
White sand	243	668	
Dark slate	26	694	
White sand	118	812	Horton Sand.
Very dark sand	28	840	
Slate and sand shells	18	858	
Black slate (oil show)	33	891	
Sand (oil and salt water)	79	970	Pike Sand.

No. 12—Jack Allen farm—Right Beaver, near Salt Lick.

Conductor	29	29	
Sand	26	55	
Slate	35	90	
Sand	12	102	All Coal Measures and Conglomerate.
Slate	55	157	
Gray sand	44	201	
Light slate	15	216	
Blue sand	5	221	
Black slate	22	243	
Dark gray sand	12	255	
Light slate	35	290	
Black sand	3	293	
Light slate	47	340	
Gray sand	18	358	
Black slate	10	368	
Black sand	19	387	
Light slate	27	414	

	Thickness.	Depth.	Geological Formation.
Gray and white sands (gas and salt water)	238	652	Beaver Sand.
Coals	2	654	
White sand	8	662	
Dark slate	22	684	
White sand	114	798	Horton Sand.
Black slate	5	803	
Gray and black sands	44	847	
Very black slate	53	900	
Light sand	11	911	
Light slate	3	914	
Dark gray sand	2	916	
Black slate	8	924	
Sand (oil)	28	952	Pike Sand.

No. 13—Wallen farm—Beaver, below mouth of Salt Lick.

Conductor	22	22	
Slate	18	40	
Coal	4[2]	44	
Black slate	51	95	
Coal No. 1	4[2]	99	All Coal Measures and Conglomerate.
White sand	28	127	
Black slate	28	155	
Gray sand	15	170	
Light slate	17	187	
Coal	3[2]	190	
Light slate	20	210	
Sand	3	213	
Light slate	85	298	
Light sand	22	320	
Light slate	5	325	
Light sand	22	347	
Slate	183	530	
Dark sand	5	535	
Black slate	45	580	
White sand (gas)	124	704	Beaver Sand.
Light slate	10	714	
White sand	129	843	Horton Sand.
Light slate	5	848	
White sand	67	915	Pike Sand.
Coal	3[2]	918	
Sand	35[2]	953	
Dark slate	5	958	
Dark gray sand	19	977	
Very black slate	87	1,064	
Sand (gas)	49	1,113	Salt Sand.
Black slate	3	1,116	

No. 14—Near Howard's Store—Right Beaver.

Conductor	31	31	
Gray sand	50	81	
Dark slate	60	141	All Coal Measures and Conglomerate.
Gray sand	13	154	
Dark slate	74	228	
Gray sand	43	271	
Dark slate	216	487	
White sand (gas)	171	658	Beaver Sand.

	Thickness.	Depth.	Geological Formation.
Dark slate	2	660	
White sand (salt water)	104	764	Horton Sand.
Gray sand	22	786	
White sand	108	894	
Coal	1[2]	895	
Gray sand	20	915	
Dark slate	20	935	
Gray and white sands (gas and oil)	107	1,042	Pike Sand.

No. 15—Dan. Howard farm—Right Beaver, above Salt Lick.

Conductor	52	52	
Gray sand	15	67	All Coal Measures and Conglomerate.
Dark slate	12	79	
Gray sand	14	93	
Dark slate	72	165	
Gray sand	45	210	
Dark slate	212	422	
White sand (gas)	231	653	Beaver Sand.
Dark slate	40	693	
White sand (salt water)	107	800	Horton Sand.
Coal	1[2]	801	
Gray and white sands	14	815	
Dark slate	4	819	
Black sand	15	834	
Black slate	46	880	
Gray and white sands (gas and oil)	59	939	Pike Sand.

No. 16—Tucker Allen farm—Right Beaver, above Goose Creek.

Conductor	43	43	
Gray sand	15	58	All Coal Measures and Conglomerate.
Gray slate	41	99	
Gray sand	56	155	
Gray slate	107	262	
Gray sand	40	302	
Gray slate	78	380	
Gray sand (gas)	58	438	
Dark slate	42	480	
White sand	168	648	Beaver Sand.
Dark slate	32	680	
White sand	94	774	Horton Sand.
Dark slate	41	815	
Gray sand	10	825	
Black slate	10	835	
Black and gray sands	4	839	
Yellow slate	6	845	
Gray and white sands (oil and gas)	92	937	Pike Sand.
Dark slate	10	947	
White sand (salt water)	28	975	Salt Sand.
Dark slate	30	1,005	

No. 17—Webb farm—Henry Br. of Right Beaver.

	Thickness.	Depth.	Geological Formation.
Soil	27	27	
Very dark slate	6	33	
White sand	45	78	
Light shale	72	150	
Gray sand	59	209	
Dark slate	17	226	
Gray sand	25	251	
Dark slate	21	272	
Gray sand	18	290	
Dark slate	160	450	
White sand	60	510	Beaver Sand.
Dark slate	7	517	
White sand	103	620	Horton Sand.
Dark slate	8	628	
White sand	20	648	
Dark slate	24	672	
White sand	63	735	Pike Sand.
Gray sand	15	750	
Black slate	12	762	
White sand (gas)	95	857	Salt Sand.
Dark slate	15	872	Base of Conglomerate Measures.
Red shale	76	948	Chester (Mauch Chunk).
Slate and shells	177	1,125	
Sub. Carb. lime	195	1,320	St. Louis.
Red shale	35	1,355	Logan Shales.
Shelly slate	205	1,560	Waverly (Pocono).
Black slate	76	1,636	
Very dark sand	90	1,726	
Brown slate	204	1,930	Devonian.

The 90-foot sand reported at 1,636 is at the place of the Berea grit.
No Big Injun sand shown.

These Floyd county records have been chosen from a large number of records to show the position of the four Conglomerate sands, and the section of the rocks under the Conglomerate measures. In other records the sands constituting the Beaver, Horton, Pike and Salt sands are often, one or more of them, broken by the interpolation of beds of slate or by two of the sands coming together, or by one of the sands suddenly thinning down, to come in again elsewhere, this irregularity being everywhere characteristic of the Conglomerate measures.

PIKE COUNTY WELLS.

No. 1—Schomberg Well—Caney Fork of John's Creek.

	Thickness.	Depth.	Geological Formation.
Drift	42	42	
Slate	30	72	Coal Measures and Conglomerate to 1,336.
Gray sand	32	104	
Slate	216	320	
Gray sand	35	355	
Slate	66	421	
Sand	57	478	
Slate	13	491	
Lime	8	499	
Sand	9	508	
Lime	5	513	
Sand	8	521	
Slate	20	541	
Sand	22	563	
Slate	12	575	
Sand	65	640	Beaver Sand.
Slate	15	655	
White sand	230	885	Horton Sand.
Slate	30	915	
Sand	421	1,336	Pike and Salt Sands. Base of Conglomerate Measures.
Red rock	18	1,354	Chester Group (Mauch Chunk).
Slate	5	1,359	
Sand	77	1,436	
Red shale	8	1,444	
Red shale and slate	56	1,500	
Gray and white lime	240	1,740	St. Louis, with oil and gas at 1,615.
Slate	45	1,795	Big Injun Group.
Reddish sand	80	1,875	
Slate	260	2,135	Pocono Slate.

No. 2—Cedar Creek.

Drift	52	52	
Slate	42	94	Coal Measures and Conglomerate to 1,181.
Light sand	36	130	
Light slate	88	218	
Light sand	33	251	
Light slate	79	330	
Black slate	45	375	
Gray sand	51	426	
Slate	53	479	
White sand	77	556	Beaver and Horton Sands.
Black sand (gas)	8	564	
Sand (salt water)	193	757	
Black slate	64	821	
White sand	49	870	Pike Sand.
Brown sand	10	880	
Light slate	50	930	

	Thickness.	Depth.	Geological Formation.
White sand (gas and salt water)	190	1,120	Salt Sand.
Gray sand	12	1,132	
Black slate	49	1,181	Base of Conglomerate Measures.
Black sand	14	1,195	Chester Group (Mauch Chunk).
Dark slate	16	1,211	
Dark limy sand	25	1,236	
Black lime	12	1,248	
Shelly slate	10	1,258	
Red shale	20	1,278	
Gray sand	3	1,281	
Red shale	69	1,350	
Gray lime	1	1,351	St. Louis—nearly cut out.
White sand	62	1,413	Keener Sand.
Black slate	27	1,440	
White sand (oil and salt water)	61	1,501	Big Injun, with oil and salt water.

No. 3—May farm—Bear Fork of Robinson Creek.

Drift	34	34	
Gray sand	27	61	
Slate	32	93	Coal Measures and Conglomerate to 1,400.
Dark sand	53	146	
Black slate	3	149	
Dark sand	11	160	
Sandy slate	18	178	
Blue sand (salt water)	59	237	
Black slate	7	244	
White sand	78	322	
Sandy slate	30	352	
Black slate	32	384	
Blue sand	21	405	
Black slate	57	462	
Blue sand	17	479	Beaver Sand.
White sand	20	499	
Black slate	67	566	
Gray sand	150	716	Horton Sand.
White sand (salt water)	129	845	
Black slate	35	880	
White sand (gas and salt water)	146	1,026	Pike Sand.
Gray sand	18	1,044	
White sand (salt water)	231	1,275	
Black slate	32	1,307	
Dark slate	33	1,340	
White sand	12	1,352	Salt Sand.
Gray sand	48	1,400	
Light slate	90	1,490	Base of Conglomerate Measures.
Red shale	6	1,496	Chester Group (Mauch Chunk).
Slate	33	1,529	
Gray sand	63	1,592	
Lime	8	1,600	May be part of Mt. Lime.
Slate	30	1,630	
Gray sand	33	1,663	Big Injun.
White sand (gas)	23	1,686	
Dark slate	65	1,751	Pocono Slate.

No. 4—Big Creek.

	Thickness.	Depth.	Geological Formation.
Drift	24	24	
Slate	10	34	Coal Measures and
Gray sand	12	46	Conglomerate to 1,525.
Dark slate	8	54	
Gray sand	35	89	
Slate	10	99	
Gray sand	21	120	
Dark slate	4	124	
Sand	15	139	
Dark slate	46	185	
Limy sand	15	200	
Gray sand	55	255	
Slate	80	335	
Coal	4	339	
Sand	42	381	
Slate	64	445	
Lime	10	455	
Slate	30	485	
Black sand	10	495	
Slate	15	510	
Sand	75	585	
Slate	15	600	
White sand	355	955	Beaver Sand (Thickened).
Slate	27	982	
Gray sand	22	1,004	
Light gray sand	47	1,051	Horton Sand.
Limy gray sand	14	1,065	
White sand	47	1,112	
Coal	3[2]	1,115	
White sand (gas and salt water).	134	1,249	Pike Sand.
Coal	3[2]	1,252	
Dark sand	12	1,264	
Dark slate	24	1,288	
White sand	152	1,440	Salt Sand.
Very black slate	24	1,464	
White sand (salt water)	61	1,525	Chester and Mountain
Sub. carb. lime	215	1,740	Lime.
Dark gray sand	25	1,765	Big Injun.
Slate	15	1,780	

No. 5—Flem. Maynard farm—Big Br. of Brushy Fork.

Drift	9	9	
Sand	4	13	Coal Measures and
Light slate	27	40	Conglomerate to 1,312.
Gray sand	54	94	
Dark slate	11	105	
White sand	37	142	
Dark slate	62	204	
White sand	30	234	
Black slate	16	250	
Coal	3[2]	253	
Light slate	7	260	
Gray sand	105	365	
Dark slate	31	396	
Coal	4[2]	400	

	Thickness.	Depth.	Geological Formation.
Dark slate	10	410	
Gray sand (salt water)	18	428	
Light slate	15	443	Beaver Sand.
White sand	21	464	
Dark sand	28	492	
Black slate	70	562	
White sand	21	583	Horton Sand.
Slate	208	791	
White sand (gas and salt water).	251	1,042	Pike Sand.
Black slate	13	1,055	
Blue sand	12	1,067	
Black slate	68	1,135	
Sand (gas and salt water)	88	1,223	
Dark sand	8	1,231	Salt Sand.
White sand	56	1,287	
Coal	1	1,288	
Sand	24	1,312	Base of Conglomerate Measures.
Red shale	12	1,324	
Sandy slate	15	1,339	
White sand	61	1,400	
Lime	12	1,412	
Slate	8	1,420	
White sand	49	1,469	Chester Group (Mauch
Dark sand	28	1,497	Chunk).
Sandy slate	24	1,521	
Gray sand	18	1,539	
Sandy slate	27	1,566	
Lime (red shale at base)	214	1,780	St. Louis.
Blue sand	20	1,800	Big Injun.
Slate	410	2,210	Pocono Slates.
Dark-brown slate	47	2,257	Devonian Shale.

These Pike county wells start near the base of Coal Measures, No. 1 coal being about 100 feet above the bed of the river at Pikeville.

KNOTT COUNTY WELLS.

No. 1—Ball's Fork, five and one-half miles from Hindman.

	Thickness.	Depth.	Geological Formation.
Soil	10	10	
Light slate	10	20	All Coal Measures and
Sand	4	24	Conglomerate.
Coal	5[2]	29	
Dark slate	5	34	
Gray sand	32	66	
Coal	3[2]	69	
Light slate	15	84	
Sand	16	100	
Slate	20	120	
Gray sand	27	147	
Coal	3[2]	150	
Black slate	16	166	
White sand	44	210	
Coal	4[2]	214	

	Thickness.	Depth.	Geological Formation.
Black slate	34	248	
Gray sand	15	263	
Light slate	60	323	
White sand	12	335	
Light slate	30	365	
Coal	4[2]	369	
Dark slate	70	439	
Gray sand	12	451	
Light slate	54	505	
Sand	20	525	
Black slate	128	653	Probable top of Conglomerate Measures.
White sand	37	690	
Dark slate	62	752	
White sand	25	777	
Shelly slate	188	965	
White sand (gas and salt water)	215	1,180	Beaver Sand.
Black slate	20	1,200	
White and dark sands	126	1,326	Horton Sand.
Dark slate (salt water)	12	1,338	
White sand (salt water)	312	1,650	Pike and Salt Sands.

No. 2—J. M. Conley farm—Head of Salt Lick Cr.

Drift	22	22	
Slate	30	52	
Sand	20	72	All Coal Measures and Conglomerate.
Coal	2[2]	74	
Dark slate	45	119	
Gray sand	3	122	
Dark slate	23	145	Top of Conglomerate Measures.
White sand	49	194	
Slate	54	248	
White sand	47	295	
Dark slate	50	345	
White sand	48	393	
Dark slate	45	438	
White sand	30	468	
Dark slate	70	538	
Gray sand	50	588	Beaver and Horton Sands.
White sand	250	838	
Coal	2	840	
Dark slate	39	879	
Gray and white sands (salt water)	105	984	Pike Sand.
Dark slate	25	1,009	
Gray sand	15	1,014	
Slate	156	1,180	
White sand (oil and salt water)	28	1,208	Salt Sand.

No. 3—Triplett well—Jones Fork.

	Thickness.	Depth.	Geological Formation.
Sand and gravel	31	31	
Slate	9	40	All Coal Measures and Conglomerate.
Coal	3	43	
Slate and sand shells	80	123	
Black shale	27	150	Probable top of Conglomerate Measures.
Sand	50	200	
Slate	30	230	
Sand	20	250	
Black slate and sand shells	150	400	
Sand (gas)	10	410	
Slate	25	435	
Sand	180	615	Beaver Sand.
Slate	35	650	
Sand	130	780	Horton Sand.
Broken sand and slate	100	880	
Sand (black oil at 990)	110	990	Pike Sand.
Black slate	10	1,000	
Slate and sand shells	51	1,051	
Top of salt sand at		1,051	Salt Sand.
Stopped in broken sand at		1,096	

No. 4—Wm. Inman farm—Rock Fork of Right Beaver.

Drift	24	24	
Slate	30	54	
Sand	12	66	
Slate	19	85	
Coal	2	87	
Slate	45	132	
Sand	15	147	
Slate	41	188	
Sand (salt water)	45	233	
Slate	68	301	All Coal Measures and Conglomerate.
Sand	8	309	
Slate	127	436	
Sand	20	456	
Slate	6	462	
Sand	18	480	
Slate	8	488	
White sand	79	567	Beaver Sand.
Slate	3	570	
White sand (gas and salt water)	115	685	
Slate	2	687	
Light sand	22	709	
Slate	38	747	
White and gray sands (salt water)	124	871	Horton Sand.
Black slate	2	873	
Gray sand (oil show)	20	893	
Black slate	2	895	
White sand (salt water)	121	1,016	Pike Sand.
Black slate	35	1,051	
White sand (oil and salt water)	106	1,157	Salt Sand.

No. 5—Andy Coburn farm—Rock Fork of Right Beaver.

	Thickness.	Depth.	Geological Formation.
Drift	26	26	
Slate	38	64	
Sand	16	80	
Coal	6[2]	86	All Coal Measures and Conglomerate.
Slate	9	95	
Sand	20	115	
Slate and red shale	145	260	
Coal	8[2]	268	
Slate	67	335	
			Probable top of Conglomerate Measures.
Dark gray sand	40	375	
White sand	10	385	
Slate	77	462	
Sand	10	472	
Slate	74	546	
Light gray sand (oil and gas)	148	694	Beaver Sand.
Slate	14	708	
Very dark sand	7	715	Horton Sand.
Gray sand (salt water)	108	823	
Slate	14	837	
Gray sand (salt water)	120	957	Pike Sand (with a break).
Slate	28	985	
White sand (gas, oil, salt water)	126	1,111	
Slate	35	1,146	
Sand and slate	27	1,173	
Gray and white sands (salt water)	31	1,204	Salt Sand (with a break)
Black slate	18	1,222	
White sand (salt water)	41	1,263	

No. 6—Esther Horton farm—Rock Fork of Right Beaver.

Drift	21	21	
Slate	100	121	
Sand	14	135	
Slate	41	176	All Coal Measures and Conglomerate.
Sand	36	212	
Slate	3	215	
Sand	35	250	
Slate	151	401	
Sand	9	410	
Slate	35	445	
White sand	213	658	Beaver Sand.
Coal	2[2]	660	
Sand	30	690	
Coal	2[2]	692	
Slate	31	723	
Sand (oil)	89	812	Horton Sand.
Slate	12	824	
Black sand	11	835	
Black slate	9	844	
Sand	13	857	
Slate	5	862	
White sand (gas, oil, salt water)	136	998	Pike Sand.
Black slate	17	1,015	
Gray sand (gas)	87	1,092	Salt Sand.
White sand	18	1,110	
Gray limy sand	29	1,139	

No. 7—Andy Coburn farm—Rock Fork.

	Thickness.	Depth.	Geological Formation.
Drift	20	20	
Slate	39	59	
Sand	21	80	
Slate	12	92	All Coal Measures and Conglomerate.
Coal	8	100	
Sand	42	142	
Slate	48	190	
Sand	48	238	
Slate	242	480	
Sand (gas and salt water)	228	708	Beaver Sand.
Slate	44	752	
Sand	20	772	
Slate (salt water)	16	788	
Sand	63	851	Horton Sand.
Black slate	12	863	
Gray sand	9	872	
Black slate	9	881	
White sand	52	933	Pike Sand (with break).
Black slate	4	937	
White sand	82	1,019	
Black slate	28	1,047	
White sand	51	1,098	Salt Sand (with break).
Slate and shells	21	1,119	
White sand (salt water)	29	1,148	

No. 8—Webb farm—Above mouth of Jones' Fork.

Drift	35	35	
Coal	5	40	
Sand	40	80	All Coal Measures and Conglomerate.
Black slate	80	160	
Light slate	70	230	
Coal	3	233	
Slate and sand layers	207	440	
White sand	40	480	Beaver Sand.
Slate	20	500	
White sand (gas, oil, salt water)	220	720	Horton Sand.
Slate	5	725	
Sand (salt water)	127	852	Pike Sand.
Slate	35	887	
Black sand	25	912	Salt Sand.
White sand	94	1,006	
Black slate to bottom.			

No. 9—Lindsay Triplett farm—Jones' Fork.

	Thickness.	Depth.	Geological Formation.
Soil	36	36	
Slate	6	42	
Black sand	160	202	
Gray sand	110	312	All Coal Measures and Conglomerate.
Slate and shells	160	472	
Gray sand	100	572	
Slate	5	577	
White sand (salt water)	203	780	Beaver Sand.
Slate and shells	75	855	
Black sand	20	875	
Slate	25	900	
White sand	125	1,025	Horton Sand.
Slate	25	1,050	
White sand	75	1,125	Pike Sand.
Slate	20	1,145	
White sand	30	1,175	
Black slate	5	1,180	
White sand (salt water)	32	1,212	Salt Sand.

KNOX COUNTY WELLS.

No. 1—John J. Disney farm—Big Richland Creek.

	Thickness.	Depth.	Geological Formation.
Soil	15	15	
Slate	35	50	
Sand	5	55	All Coal Measures and Conglomerate.
Slate	45	100	
Shale	140	240	
Sand (oil show)	20	260	Wages Sand.
Shale	5	265	
Sand	10	275	
Shale	85	360	
Sand	20	380	
Black sand (Oil, gas and salt water.)	33	413	
Gray sand (Oil, gas and salt water.)	79	492	Jones Sand.
Light sand (Oil, gas and salt water.)	68	560	

No. 2—W. M. Gilbert farm—Big Richland Creek.

Sand	60	60	
Shale	120	180	
Coal	6	186	
Sand	18	204	All Coal Measures and Conglomerate.
Shale	66	270	
Sand (salt water)	25	295	
Shale	133	428	
Sand (oil at 445)	67	495	Jones Sand.

No. 3—Anthony Mills farm—Goose Creek.

	Thickness.	Depth.	Geological Formation.
Soil	6	6	
Slate	1	7	
Gravel	9	16	
Slate	74	90	All Coal Measures and Conglomerate.
Coal	7	97	
Gumbo	1[2]	98	
Slate	55	153	
Sand	20	173	
Shale	10	183	
Slate	26	209	
Sand	15	224	
Slate	52	276	
Salt sand	7	283	
Slate	92	375	
Sand	14	389	

No. 4—Madeline Gray farm—Gray's Station.

Soil	20	20	
Shale	80	100	
White sand	215	315	
Black shale	30	345	
Sand	150	495	Coal Measures and Conglomerate.
Shale	8	503	
Sand	129	632	
Coal	3	635	
Sand	275	910	
Red shale	40	950	
Black shale	20	970	
Sand	10	980	
Red shale	25	1,005	
Hard, black shale	24	1,029	Chester.
Red shale	41	1,070	
Hard lime	10	1,080	
Black shale	28	1,108	
Gray lime	70	1,178	
Soft shale	5	1,183	
White, hard lime	90	1,273	
Soft, black lime	4	1,277	
Hard, gray lime	24	1,301	St. Louis.
Blue lime	20	1,321	
Gray lime	15	1,336	
White lime	14	1,350	
Dark gray lime	19	1,369	
Sand	7	1,376	Big Injun.
Coarse, green sand	20	1,396	
Black shale	24	1,420	
White shale	5	1,425	
Dark shale	15	1,440	
Dark sand	5	1,445	
Dark shale	10	1,455	Waverly.
Pale-green sand and shale	20	1,475	
Shale and sand	10	1,485	
Dark shale and sand	15	1,500	
Shale and sand	40	1,540	

	Thickness.	Depth.	Geological Formation.
Sand, lime and shale	32	1,572	Waverly, continued.
Light sand	15	1,587	
Light shale	13	1,600	
Sand and shale	15	1,615	
Lime and shale	50	1,665	
Black shale	120	1,785	Devonian Shales.
White shale	5	1,790	
Sand	5	1,795	
Light shale	25	1,820	Niagara and Clinton. (Base uncertain.)
Lime	2	1,822	
Light shale	30	1,852	
Shale and sand	48	1,900	
Light shale	30	1,930	
Lime	5	1,935	
Light shale	20	1,955	
Sand	7	1,962	
Sand and shale	12	1,974	

No. 5—Jones farm, near Girdler P. O.—Typical "Jones Sand" well.

Soil	17	17	
Sand	15	32	
Gray shale	25	57	All Coal Measures and Conglomerate.
Gray sand	33	90	
Black shale	140	230	
Sand	20	250	Wages Sand.
Mixed shale	100	350	
Black shale and coal	15	365	
Stray sand (oil)	10	375	Stray Sand.
Sand (oil)	15	390	Jones Sand.

No. 6—Jones "Gusher"—Si. Jones farm—Little Richland Creek.

Clay	8	8	
Slate	30	38	All Coal Measures and Conglomerate.
Sand (black oil show)	70	108	
Slate	100	208	
Sand	20	228	Wages Sand.
Slate	70	298	
Sand	8	306	Stray Sand.
Slate	44	350	
Sand (oil)	30	380	Jones Sand.

No. 7—Joseph A. Miller farm—Little Richland Creek.

Soil	15	15	
Sand	25	40	All Coal Measures and Conglomerate.
White slate	20	60	
Brown shale	20	80	
Slate	60	140	
Sand (show of oil)	20	160	Wages Sand.
Slate	85	245	
Sand	15	260	Stray Sand.
Slate	30	290	
Black slate (salt water and gas)	5	295	
Sand	68	363	Jones Sand.

No. 8—John Wages farm—Little Richland Creek.

	Thickness.	Depth.	Geological Formation.
Clay	9	9	All Coal Measures and Conglomerate.
Shale	30	39	
Sand (black oil)	15	54	Wages Sand No. 1.
Slate	50	104	
Sand	20	124	
Slate	20	144	
Sand (oil)	18	162	Wages Sand No. 2.

No. 9—Barbourville.

Dark shale	90	90	(All Coal Measures and Conglomerate).
Fine, gray sand	20	110	Wages Sand.
Dark gray sand	90	200	
Gray sand	15	215	
Dark shale	25	240	
Sand and black shale	25	265	
Gray sand	10	275	Jones Sand.
Fine, gray sand	65	340	
Black shale and sand	78	418	
Fine, gray sand	42	460	
Dark shale and sand	75	535	
Fine, gray sand	5	540	Epperson Sand.
Fine, brown sand	10	550	
Brownish sand (oil)	5²	555	
Brown sand (salt water)	25	580	

Limestone reported at 1,200 feet.

No. 10—Dozier farm—Fighting Creek.

Sand	16	16	
Shale	25	41	
Coal	3	44	All Coal Measures and Conglomerate.
Black shale	123	167	
Lime	23	190	
Sand	35	225	Wages Sand.
Lime	15	240	
Slate	120	360	
Sand	100	460	Jones Sand.
Slate	15	475	
Sand	250	725	Epperson Sand.
Coal	2	727	
Sand	173	900	Salt Sand.

The lime reported in this well at 190 and 240 is probably close, hard sand.

Enough deep drilling has been done in Knox county to demonstrate, when the records are combined with those from adjoining counties, the presence of the Big Injun sand under the whole area at average depths of from 1,200 to 1,400 feet. At points in this county this sand has already given strong flows of gas and this, with the reputation this sand already has as a producer in other localities, combined with the moderate depth at which it can be reached, ought to make it worthy of a more extended test of its possibilities as a producer here.

ROCKCASTLE COUNTY WELL.

Near Mullen's Station.

	Thickness.	Depth.	Geological Formation.
Conglomerate	100	100	Conglomerate.
St. Louis limestone	100	200	St. Louis.
Fine sand	150	350	Waverly.
Shale	200	550	
Black shale	150	700	Devonian Shale.
Heavy, sandy limestone	20	720	Corniferous.
Shale	30	750	Niagara Shale.
Shaly, blue limestone	300	1,050	Hudson, with probably some Upper Silurian at the top.
Sandy limestone	90	1,140	
Thin, crystalline limestones	200	1,340	
Gray, crystalline limestones	150	1,490	Trenton (?).
White, lithographic limestones	—	—	Birdseye (?)

The upper part of the 150 feet of sand shown under the St. Louis L. S. belongs to the "Big Injun."

PULASKI COUNTY WELL.

Well at Eubanks.

Depth.		Geological Formation.
At 50	—Very light, fine-grained, soft lime	St. Louis.
" 120	—Dark shale	Waverly (50 to 360).
" 160	—Dark shale	
" 360 to 400	—Black shale	
At 400	—Dark gray, crystalline lime	Devonian.
" 510	—Gray lime	Corniferous.
" 540	—Dark, greenish-gray, shaly lime	(Clinton and Niagara not shown). Top of Hudson about 425.
" 675	—Light shales and lime.	
" 695	—Mottled, red lime.	
" 700	—Mottled, red lime.	
" 728	—Mottled, gray and white lime.	
" 800	—Small flow of gas.	
" 800	—Gray lime.	
" 825	—Very dark lime.	
" 870	—Dark gray lime.	
" 928	—Very dark lime.	
" 986	—Mixed, light and dark gray lime	Top of Trenton about 950.
" 1,045	—Light lime.	
" 1,100	—Mottled, gray lime.	
" 1,125	—Mixed, gray and white lime	Top of Birdseye about 1,200.
" 1,230	—Very dark dove-colored lime.	
" 1,235	—Light dove-colored lime.	
" 1,240	—Dark dove-colored lime	Birdseye and Chazy to bottom.
" 1,245	—Hard, light-green sandstone, with dark specks.	
" 1,250	—Mottled, dove-colored lime.	
" 1,330	—Dove-colored lime.	
" 1,400	— " " "	
" 1,520	— " " "	

Bottom at 1,520.

Attention is called to a persistent bed of red rock which appears in this well at 195 feet below the Black Shale, at 185 feet below the Clinton in the Pine Knot well, at 155 feet below the Black Shale in the Dishman well in Wayne county, and at 165 feet below the Black Shale in one of the Tennessee wells. It shows at 695 and 700 in the above record. The same thing shows in Warren county in the Bowling Green well at 180 feet below the Black Shale.

WHITLEY COUNTY WELLS.

No. 1—One mile north of Pine Knot.

This well was drilled by Mr. L. E. Bryant, who kept an accurate set of samples of the drillings. The record is one of the best in that section of the State and furnishes a typical section of the Conglomerate measures in their increased thickness, and of the underlying rocks down into the upper part of the Trenton group. The well begins about 90 feet below the Laurel coal and just below the top of the Conglomerate measures.

Pine Knot well.

	Thickness.	Depth.	Geological Formation.
Sand	55	55	
Coal	½		
Sand	28	83	
Slate	10	93	
Sand	112	205	
Slate	10	215	
Sand	95	310	
Slate	10	320	
Slate and sand	10	330	
Sand	5	335	Conglomerate Measures.
Slate	5	340	
Sand	5	345	
Slate	25	370	
Sand	50	420	
Slate	20	440	
Sand	61	501	
Coal	3½	504½	
Slate	56	560	
Slate and sand	10	570	
Sand	10	580	
Slate	32	612	

	Thickness.	Depth.	Geological Formation.
Sand	23	635	
Slate	7	642	
Sand	13	655	
Slate	20	675	
Sand	10	685	
Slate	25	710	
Sand and slate	12	722	
Slate	19	741	Conglomerate Measures, continued.
Coal	6	747	
Slate and sand	13	760	
Slate	7	767	
Sand	8	775	
Slate and sand	10	785	
Sand	15	800	
Black slate	7	807	Base of Conglomerate.
Red sand	11	818	
Dark slate	3	821	
Sand	6	827	
Dark lime	20	847	
Brown, limy marl	8	855	
Dark blue slate	7	862	Chester Group.
Reddish lime	4	866	
Light brown, limy marl	10	876	
Dark blue slate	4	880	
Light brown, limy marl	5	885	
Gray, limy marl and blue slate	15	900	
Dark lime	55	955	
Light lime with oolite	20	975	
Dove-colored lime	5	980	
Dark lime and shale	5	985	
Light colored lime	20	1,005	
Dark lime with streaks of shale	25	1,030	
Dark shale and lime	5	1,035	St. Louis Group.
Dark dove-colored lime	20	1,055	
White and brown limes with layers of black slate	20	1,075	
Light brown lime	5	1,080	
Gray limy shale	5	1,085	
Brown lime	20	1,105	
Light dove-colored and white limes	190	1,295	
Light brown lime	5	1,300	
Light green, sandy lime	5	1,305	
Very light brown, sandy lime	15	1,320	Oil Show.
Very dark lime and slate	10	1,330	
Gray lime	20	1,350	
Dark, limy sand	10	1,360	
Brownish, impure lime	10	1,370	
Dark, limy slate	10	1,380	
Very dark lime	30	1,410	
Dark, limy slate	5	1,415	
Dark lime	5	1,420	
Dark slate	8	1,428	Keokuk—Waverly Group.
White and gray limes	12	1,440	
Light lime	20	1,470	
Gray and white limes	20	1,490	
Hard, dark and white sands	5	1,495	
Alternating, gray and white sands and sandy limestones	65	1,560	

	Thickness.	Depth.	Geological Formation.
Soft, limy shale and hard sand shell	5	1,565	Keokuk-Waverly Group, continued.
Gray, sandy lime	5	1,570	
Dark, limy shale	30	1,600	
Black shale	15	1,615	
Dark brown shale	15	1,630	
Black shale	5	1,635	Devonian Shales.
Dark brown shale	5	1,640	
Black shale	5	1,645	
Dark, greenish shales	30	1,675	
Greenish-gray shales with streaks of lime and reddish shale	47	1,720	Niagara Shales.
Red iron ore at		1,720	
Iron ore, dark shales and magnesian limestone	15	1,735	Clinton.
Dark, limy shale	7	1,742	
Dark limes and limy shales	43	1,785	
Dark limes	55	1,840	
Dark gray and dark reddish limes	40	1,880	
Dark and light gray limes and dark, limy slate	35	1,915	
Dark, reddish lime	25	1,940	Hudson.
Dark gray lime	35	1,975	
Dark bluish-gray and white limes	305	2,280	
Cave in dark slate at		2,290	
Dark, bluish-gray and white limes	102	2,392	
Blue and white limes and gray lime shale	18	2,410	About base of Hudson.
Light gray lime shale with dark slate shells	12	2,422	
Gray lime	30	2,452	Trenton Group.
Grayish-brown and white crystalline limes	59	2,511	

No. 2—J. P. Sharp farm—Rockhold Station—Eastern edge of Whitley county.

Soil	14	14	
Black shale	36	50	
White lime	5	55	
Coal	1[2]	56	Coal Measures and
Blue slate	88[2]	145	Conglomerate to 1,057.
White sand	10	155	
Black slate	30	185	
White sand	20	205	
Black slate	110	315	
Gray sand	190	505	
Black slate	40	545	
White sand	165	710	
Black slate	30	740	
White sand (oil show)	230	970	
Black slate	35	1,005	
Sand	26	1,031	
Coal	2	1,033	
Black slate	4	1,037	
White sand	5	1,042	
Black shale	15	1,057	
			Base of Conglomerate Measures.

	Thickness.	Depth.	Geological Formation.
White lime	5	1,062	
Black shale	4	1,066	
White sand	25	1,091	
White shale	60	1,151	
White lime	54	1,205	Chester and St. Louis.
White shale	50	1,255	
White lime	30	1,285	
White shale	5	1,290	
White lime	265	1,555	
Brown sand	35	1,590	Big Injun.
Blue sand	27	1,617	
Blue shale	188	1,805	Waverly.
Brown shale	120	1,925	
White shale	15	1,940	Devonian Shales.
Brown shale	5	1,945	
White shale	60	2,005	
Red shale	5	2,010	
White shale	35	2,045	Niagara and Clinton Shales.
Red shale	15	2,060	
White shale	5	2,065	
White lime	70	2,135	
Shale	70	2,205	Hudson.
White lime	25	2,230	

WAYNE COUNTY WELLS.

In Wayne but few complete records have been kept, in the great majority of wells the depth of the pay below the surface being all that is recorded. Logs of two deep wells showing the section down to very old rocks are given, with a log showing the average section for 1,000 feet in depth and logs showing the Mt. Pisgah gas field. These, with the average depths given for the Beaver sand, cover the field fairly well. In the northwestern part of the county, the Black Shale comes to the surface and the Beaver sand is above drainage. The first two records show the increased thickness of the Trenton group, with the Knox dolomite coming in above the Calciferous.

No. 1—H. McBeath farm.

	Thickness.	Depth.	Geological Formation.
Surface	0	0	
Space (lime and shales)	764	764	St. Louis, Keokuk and Waverly.
Beaver sand (thin)	8	772	
Space (slate)	50	822	
Black shale	35	857	Devonian.
Lime (includes both Sunnybrook sands)	803	1,660	Hudson and Upper Trenton.
White slate	3	1,663	Top of Birdseye.
Dark brown lime	277	1,940	
Lime shells and slate	260	2,200	
Dark brown lime	30	2,230	Birdseye and Chazy and Knox Dolomite.
Dark and light lime	170	2,400	
Flint shells	30	2,430	
White salt sand	5	2,435	Top of Calciferous.

Well started near top of St. Louis Group.

The Trenton Group includes about 250 feet of the lower part of the 803 feet of limestone, and also the Birdseye and Chazy down to about 2,230, and the Knox Dolomite down to 2,430.

The upper part of the 803 feet of limestone is mostly Hudson, with probably a very little Clinton at the top.

No. 2—J. W. Barnes farm.

	Thickness.	Depth.	Geological Formation.
Lime	254	254	
Gray slate	140	394	
Gray and white lime and slate	46	440	Beaver Sand.
Black shale	40	480	Devonian.
Blue lime	100	580	
Pepper and salt lime	300	880	Hudson and Upper Trenton.
Brown lime	200	1,080	
Blue slate	10	1,090	
Dark lime	200	1,290	Top of Birdseye.
Brown flint	60	1,350	
Blue lime	540	1,890	
White sand (oil show)	25	1,915	
Brown, flinty lime	15	1,930	Birdseye and Chazy and Knox Dolomite.
Light brown sand	5	1,935	
White lime	10	1,945	
Lime	10	1,955	
White salt sand	26	1,981	Calciferous.

No. 3—J. A. Brown farm.

	Thickness.	Depth.	Geological Formation.
Soil	35	35	
White lime	165	200	
Hard, black sand (gas at 335)	138	338	About base of St. Louis Group.
Soft, black slate	2	340	Waverly—Keokuk Group.
White sand (gas)	2	342	
Black lime	8	350	
White lime (gas)	50	400	
Black slate	75	475	
White lime	10	485	
Black slate	5	490	
Hard, white sand	12	502	
Hard, white lime	48	550	
Blue slate	30	580	
Pay sand ("Beaver" sand) oil	8	588	
Blue slate	2	590	

No. 4—Well west of Mill Springs. (Starts in base of St. Louis.)

Lime	360	360	
Beaver sand	11	371	
Black shale		380	Devonian Shale.
Sunnybrook sand		810 to 960	
Bottom		1,003	Bottom in Trenton L. S.

This record shows reputed thickness of the Sunnybrook sand. The upper pay in this is in Lower Hudson and the second in the Trenton.

No. 5—Dishman well.

	Thickness.	Depth.	Geological Formation.
Hard, white limestone	170	170	St. Louis.
White sandstone	100	270	May be Big Injun.
Limestone	310	580	
Sandstone	30	610	Beaver Sand.
Black shale	35	645	Devonian.
Slate and shells	35	680	Probably Clinton.
Limestone	120	800	Hudson and Upper Trenton.
Slate and red rock	20	820	
Soft, slaty lime	448	1,268	
Slate and shells	28	1,296	
Black pencil cave	4	1,300	
Slate and shells	20	1,320	
White cave	5	1,325	

The base of the Hudson is probably about 1,268, showing a slight thickening south from the Cumberland river.

No. 6—Duncan & Bohon farm.

	Depth.
Top of "Beaver" sand	730
Bottom of "Beaver" sand	736
Top of Black Shale	765
Bottom of Black Shale	807

No. 7—Cyrus Brown farm.

	Thickness.	Depth.	Geological Formation.
Hard, white limestone	105	105	
Bluish-white limestone	10	115	
White lime	60	175	About base of St. Louis.
Dark lime (gas at 205)	69	244	Waverly—Keokuk Group.
White lime	55	299	
Hard, black lime (gas at 305)	30	329	
Hard, dark lime	40	369	
Hard, white lime	20	389	
Soft, white lime	116	505	
Dark slate	25	535	
Hard shell	10	545	
White sand (Beaver sand)	13	558	
Dark shale	40	598	Devonian Black Shale.
Dark sand	15	613	
Dark lime	477	1,090	
Brown lime	210	1,300	
Dark lime	45	1,345	
Dark flint	5	1,350	
Dark lime	152	1,502	

Bottom of well is probably in the Chazy limestone.

No. 8—J. H. Duncan well.

	Thickness.	Depth.	Geological Formation.
Clay	44	44	
Lime	319	363	St. Louis and Keokuk.
White slate	60	423	Waverly Shale.
Black shale	34	457	Devonian.
Lime	493	950	Hudson and Trenton.
Sunnybrook sand	120	1,070	
Lime	88	1,158	

R. E. Vickery farm.

	No. 1	No. 2	No. 3	No. 4	No. 5
Top of Beaver sand	414	417	412	409	403
Bottom of Beaver sand	430	432	430	423	419

Hurt farm—Cooper District.

	No. 1	No. 2
Top of Cooper sand	346	434
Bottom of Cooper sand	360	450

Mt. Pisgah gas wells. (Start in St. Louis L. S.)

No. 1—Depth, 200 feet.
Capacity about 7,000,000 feet per day.

No. 2—Gas at 260.
Top of Black Shale, 430.
Capacity, 2,000,000 feet per day.

No. 3—Gas at 260.
Top of Black Shale, 445.
Capacity, 3,000,000 feet per day.

These three wells were drilled deeper, but the main flow of gas is given at 260 below the surface.

In the Cooper, Beaver Creek, Steubenville, Chenoe and Mill Springs districts, the records show the Beaver sand just above the Black Shale and at depths varying from 340 to 600 or more feet, according to the elevation of the surface.

CLINTON COUNTY WELLS.

No. 1—Sarah Sidwell farm—Cartwright district.

	Depth.
Starts about at top of Waverly	0
Top of Black Shale	350
Base of Black Shale	380
Limestone to bottom at	1,150
Gas and amber oil in Hudson at	649

No. 2—W. J. Williams farm—Cartwright district.

Starts near top of Waverly	0
Top of Black Shale	330
Base of Black Shale	355
Limestone to bottom.	
Green oil from 836 to 854 in Hudson.	

CUMBERLAND COUNTY WELLS.

The Cumberland county wells all start in the Hudson, at varying distances below the Black Shale, and are entirely within the Hudson and Trenton groups, with the greatest part of their depth in the latter. The Hudson here is cut down in thickness to probably about 450 feet. In the Trenton group are here included all the rocks from the top of the Trenton (Bluegrass) limestones proper, down through the Birdseye, Chazy and Knox dolomite. This is the arrangement adopted by Dr. Safford in his report on the geology of Tennessee, and is used here provisionally and until a more definite classification can be given to this group.

As will be seen from these records, the limestones under the Chazy have thickened very much, one record (No. 20) showing over 1,250 feet of limestones below the top of the Trenton group, with an oil-bearing sand nearly 1,000 feet below the top of the Trenton, and the base of the limestone series still not reached. These records show a list of limestones of such varying hardness and color as to make it impossible at present to draw the line exactly between the Hudson and Trenton rocks, but the approximate position of the oil and gas-bearing horizons (as to whether in Hudson or Trenton groups) is given as closely as possible. The only definite mark in the field seems to be the green "pencil cave." The best production is below this and apparently from limestones in the Chazy, but at no fixed distance below the pencil cave.

No. 1—Wm. Hurt farm.

	Thickness.	Depth.	Geeological Formation
Blue lime	60	60	
Gray lime (gas)	125	185	Hudson.
Gray lime	140	325	
Black lime (gas)	45	370	Hudson.
Gray lime	55	425	
Gray lime	50	475	
Gray lime (gas)	30	505	Trenton.
Black lime	40	545	
White lime	90	635	
Gray lime	30	665	
Gray lime	115	780	
Gray lime	70	850	
Gray lime (show of oil and gas)	65	915	Trenton.
Gray lime	125	1,040	
Gray lime	215	1,255	
White lime	7	1,262	

No. 2—Wm. Hurt, No. 2.

Blue lime	300	300	
Gray lime	100	400	
Black lime	220	620	All in Hudson and
Gray lime	30	650	Trenton Groups.
White lime	70	720	
Gray lime	280	1,000	

Pencil cave at 625.

No. 3—B. F. Irvine farm.

	Thickness.	Depth.	Geological Formation.
Soft, blue lime (oil)	75	75	Hudson.
Soft, black lime (salt water)	125	200	
Soft, gray lime (sulphur water)	200	400	
Hard, white lime (salt water)	40	440	
Soft, gray lime (sweet water)	20	460	
Soft, black lime (gas)	60	520	Trenton.
Soft, gray lime (pencil cave)	50	570	
Hard, gray lime (bitter water)	40	610	
Soft, gray lime (salt water)	40	650	
Hard, gray lime (salt water)	25	675	
Soft, white lime (salt water)	20	695	
Hard, white lime (salt water)	55	750	
Soft, gray lime (salt water)	95	845	
Hard, gray lime (copper water)	80	925	
Soft, gray lime	75	1,000	

No. 4—Wm. Bryant farm.

White lime	50	50	
Blue lime (gas at 225)	200	250	Hudson.
Gray lime	50	300	
Blue lime	75	375	
Gray lime	50	425	
Gray lime	150	575	
Dark gray lime (pencil cave at 600)	50	625	
White lime	100	725	
Gray lime	30	755	
Dark gray lime	100	855	
Gray lime	50	905	
Gray lime	75	980	
Gray lime	52	1,032	

No. 5—W. M. Bryant, No. 2.

Blue lime	100	100	
Hard, black lime	30	130	
Soft, black lime	350	480	
White lime (small gas)	20	500	Trenton.
Brown lime	20	520	
White lime	20	540	
Brown lime	20	560	
White lime	15	575	
Gray lime	83	658	
Pencil cave	2	660	
White lime	90	750	
Brown lime	360	1,110	
Gray lime	270	1,380	
Brown lime	20	1,400	

No. 6—Ellen Smith farm.

	Thickness.	Depth.	Geological Formation.
Soil	10	10	
Blue lime	90	100	
Black lime	20	120	
Gray lime (gas at 135)	50	170	Hudson.
Gray lime	22	192	
Brown lime (gas at 220)	60	252	Hudson.
Black lime	150	402	
Gray lime	108	510	
Black lime (gas at 520)	80	590	Trenton.
Green pencil cave	3	593	
Brown lime	30	623	
Brown lime and sand	93	716	
Brown lime	69	785	
Brown lime	18	803	
Brown lime	85	888	
Brown lime	81	969	
Brown lime (oil show at 975)	12	981	Trenton.
Gray lime	6	987	
Brown lime	18	1,005	

No. 7—Cloyd Heirs, No. 3.

Soil	42	42	
Blue lime	160	202	
Black lime	30	232	
Gray lime	40	272	
Brown lime	30	302	
Gray lime	75	377	
Brown lime	70	447	
Black lime (gas at 445)	48	495	Trenton.
Brown lime	7	502	
Green pencil cave	2	504	
Hard, brown lime	5	509	
Soft, brown lime	30	539	
Brown lime and sand	131	670	
Soft, brown lime	15	685	
Hard, brown lime	85	770	
Soft, brown lime	75	845	
Gray lime	18	863	
Dark brown lime	20	883	
Brown lime	57	940	
Brown lime	40	1,120	
Light gray lime	60	1,080	
Brown lime	40	1,120	
Black lime	80	1,200	
Light brown lime	60	1,260	
Gray lime	60	1,320	
Brown lime	20	1,340	
White lime	20	1,360	
Brown lime	30	1,390	
White lime	30	1,420	
Gray lime	80	1,500	

No. 8—J. E. Heard farm, No. 1.

	Thickness.	Depth.	Geological Formation.
Dark gray lime	250	250	
Gray lime	20	270	
Dark brown lime	55	325	
Dark gray lime	30	355	
Gray lime	45	400	
Light brown lime	48	448	
Gray lime (gas at 448)	44	492	Trenton.
Dark blue lime (oil show at 492)	12	504	Trenton.
Gray lime (oil show at 505)	12	516	Trenton.
Green pencil cave	3	519	
Gray lime	6	525	
Brown lime (gas at 525)	24	549	Trenton.
Dark gray lime	25	574	
Light gray lime	35	609	
Light brown lime	23	632	
Brown lime	6	638	
Dark blue lime	15	653	
Gray lime	32	685	
Brown lime	15	700	
Brown lime	150	850	
Light brown lime	50	900	
Gray lime	40	940	
Brown lime	60	1,000	

No. 9—J. E. Heard farm, No. 2.

Dark blue lime	200	200	
Blue lime	60	260	
Gray lime	43	303	
Dark gray lime	60	363	
Brown lime	33	396	
Dark gray lime	29	425	
Light gray lime	40	465	
Gray lime	60	525	
Black lime	30	555	
Lime and sand	18	573	
Green pencil cave	2	575	
Brown lime	30	605	
Gray lime	18	623	
Lime and sand (oil show at 654)	47	670	Trenton.
Dark brown lime	24	694	
Brown lime	21	715	
Gray lime	43	758	
Dark brown lime	32	790	
Brown lime	10	800	

No. 10—J. E. Heard farm, No. 3.

Blue lime	75	75	
Gravel	3	78	
Blue lime	80	158	
Black lime	50	208	
Gray lime	30	238	
Blue lime	20	258	
Dark blue lime	25	283	

	Thickness.	Depth.	Geological Formation.
Lime and sand (heavy gas flow at 290)	15	298	Trenton.
Brown lime	50	348	
Light brown lime	60	408	
Brown lime	30	438	
Gray lime	10	448	
Light gray lime	45	493	
Black lime	30	523	
Lime and sand	9	532	
Green pencil cave	3	535	
Brown lime	30	565	
Green lime	56	621	
Brown lime (oil at 643)	22	643	Trenton.
Light brown lime	21	664	

No. 11—J. E. Heard farm, No. 4.

Blue lime	60	60	
Black lime	30	90	
Gray lime	60	150	
Blue lime	40	190	
Dark blue lime	30	220	
Lime and sand	65	285	
Brown lime (gas at 290)	50	335	Trenton.
Light brown lime	60	395	
Light gray lime	10	405	
Gray lime	40	445	
Light gray lime	25	470	
Black lime	30	500	
Lime and sand	10	510	
Green pencil cave	3	513	
Brown lime (gas at 520)	25	538	Trenton.
Lime and sand (gas at 555)	17	555	Trenton.
Brown lime (oil at 567)	12	567	Trenton.
Brown lime	33	600	
Dark brown lime	20	620	
Brown lime (gas at 625)	5	625	Trenton.
Brown lime (oil at 629)	4	629	Trenton.
Brown lime	17	646	
Brown lime	20	666	
Light brown lime (gas at 685)	19	685	Trenton.
Brown lime (oil at 712)	27	712	Trenton.
Brown lime	10	722	

No. 12—J. E. Heard farm, No. 5.

Blue lime	100	100	
Blue lime	150	250	
Gray lime (gas at 408)	200	450	Trenton.
Black lime	40	490	
Pencil cave	10	500	
Gray lime (oil show at 532)	200	700	Trenton.
Gray lime (oil show at 765)	201	901	Trenton.

No. 13—J. E. Heard farm, No. 6.

	Thickness.	Depth.	Geological Formation.
Soil	54	54	
Blue lime	80	134	
Gray lime	30	164	
Blue lime	36	200	
Black lime (gas at 250)	50	250	Trenton.
Blue lime (gas at 310)	60	310	Trenton.
Brown lime	100	410	
Blue lime	35	445	
Black lime (oil at 445)	30	475	Trenton.
Gray lime	5	480	
Green pencil cave	3	483	
Hard, brown lime	4	487	
Soft, brown lime	25	512	
Sandy lime (oil at 561)	49	561	Trenton.
Lime	244	805	

No. 14—J. E. Heard farm, No. 8.

Blue lime	300	300	
Gray lime	100	400	
Black lime	100	500	
Gray lime	25	525	
Pencil cave	10	535	
Gray lime	468	1,003	
Oil at 603, 671, 701 and 910			Trenton.

No. 15—J. E. Heard farm, No. 9.

Blue lime	200	200	
Gray lime	200	400	
Black lime	100	500	
Gray lime	280	780	
Pencil cave at 525.			
Oil at 553 and 756			Trenton.

No. 16—W. R. Neely farm.

Soil	8	8	
Blue lime	100	108	
Dark blue lime	42	150	
Black lime	132	282	
Gray lime	18	300	
Brown lime	50	350	
Dark brown lime	30	380	
Dark gray lime	20	400	
Gray lime	30	430	
Brown lime	42	472	
Black lime	53	525	
Gray lime and sand	10	535	
Pencil cave	2	537	
Gray lime	4	541	
Brown lime	30	571	
Brown lime	70	641	
Lime and sand	50	691	
Brown lime	100	791	
Brown lime	70	861	
Brown lime	13	874	

No. 17—J. W. Cloyd farm.

	Thickness.	Depth.	Geological Formation.
Lime	350	350	
Gray sand	125	475	
Lime	33	508	
White slate	2	510	
White lime (oil show at 522)	35	545	Trenton.
White lime	100	645	
White lime	55	700	
Sand	150	850	
Gray lime	30	880	
White slate	10	890	
Dark lime	35	925	
White lime	25	950	

No. 18—W. J. Hutchins farm.

Blue lime (gas at 80)	80	80	Hudson.
Light gray lime	60	140	
Gray lime	50	190	
Dark gray lime	10	200	
Brown sand	6	206	
Gray sand	7	213	
Black lime	6	219	
Brown sand	6	225	
Black lime (gas at 325)	150	375	Hudson.
Black lime	125	500	
Black lime	30	530	
Brown lime	20	550	
Brown lime	55	605	
Gray lime	30	635	
Black lime	20	655	
Gray lime	11	666	
Green pencil cave	3	669	
Brown lime	30	699	
Brown lime and sand	100	799	
Brown lime	201	1,000	

No. 19—A. M. Fudge farm.

Blue lime (gas at 150)	200	200	Hudson.
Black lime (gas at 285)	255	455	Gas in Hudson. Oil in Trenton.
(Oil show at 452.)			
Gray lime	115	570	
Black lime (pencil cave at 645)	65	635	
Gray lime	30	665	
Gray lime	165	830	
Gray lime	60	890	
Gray lime	110	1,000	

Flowing well from oil at 635 (Trenton).

Wash's Bottom.

No. 1. (R. G. Allen farm.)		No. 3. (Philpot farm.)		No. 4. (Goff farm.)	
Oil	640	Oil	500	Oil	765
Bottom	805	Oil	625	Bottom	785
		Bottom	665		

No. 2. (Stockden farm.)	
Show of oil	545
Bottom	800

In the Salt Lick Bend group, all sands are Trenton except the three gas sands in No. 10 and the 90-foot oil in No. 11.

On Marrowbone, the oil in No. 1 at 248, the oil in No. 2 at 180 and 245, the oil at 282 in No. 3, the gas in No. 5 at 95, 105, 165 and 210, the gas in No. 6 at 172, 315 and 380 and the gas in No. 7 at 110, 150 and 225, are all referred to Hudson. The lower horizons all in Trenton.

In Wash's Bottom, the oil is all in Trenton.

The following record of the old Cumberland river wells is given as a matter of interest. The accuracy of the record can not be vouched for.

Name.	Depth.	Date.
Garbertt, opposite Creelsboro	225	1861
Crocus, mouth of Crocus creek	190	1865
Egbert, ————	270	1865
Old American, Renox creek	171	1829
Sherman, ————	276	1866
Gilbreath, Bear creek	20	——
Phelps, Oil Fork	50	1866

These wells were credited with a production of many thousands of barrels of oil—probably very much more than they actually produced. They were probably all in Hudson rocks.

RUSSELL COUNTY WELLS.

No. 1—A. W. McGloud farm.

	Thickness.	Depth.	Geological Formation.
Lime	365	365	Upper Silurian and Hudson.
Red sand	4	369	
Gray lime	288	657	
Gray lime	19	676	
Light sand (black oil)	12	688	Probable base of Hudson.
Dark lime	12	700	
Dark lime	50	750	Trenton Group.
Blue slate	130	880	
Brown slate (pencil cave)	20	900	
Blue lime	30	930	

The well starts just below the base of the Black Shale.

No. 2—A. W. McGloud farm.

	Thickness.	Depth.	Geological Formation.
Dark lime	655	655	Upper Silurian and Hudson.
Light sand	8[2]	663[2]	Probable base of Hudson.
Gray lime	176[2]	840	Trenton Group.
White lime	58	898	
Pencil cave	1[2]	899[2]	
Gray lime	600[2]	1,500	
Gray lime	92	1,592	
Light sand (salt water)	35	1,627	Probably top of Calciferous.

Gas and salt water at 40 feet.
Salt water at 1,620 to 1,627.
Well starts just below the base of the Black Shale.

No. 3—F. A. Bolin farm.

Gray lime	123	123	Keokuk.
Dark sand	4	127	
Light slate	131	258	Waverly.
Black shale	30	288	Devonian Shale.
Gray lime (gas at 970)	682	970	Upper Silurian and Hudson.
White sand	10	980	About base of Hudson.
Brown lime	130	1,110	Trenton.

No. 4—John Johnson farm.

Black shale	20	20	Devonian Shale.
Blue lime (salt water at 100)	670	690	Upper Silurian and Hudson.
Sand	10	700	About base of Hudson.
Gray lime	155	855	Trenton Group.
Pencil cave	3	858	
Dark lime	642	1,500	

Bottom in Chazy limestone.

No. 5—G. B. Walton farm.

Soil	6	6	
Black shale	44	50	Devonian Shale.
Gray lime	10	60	Upper Silurian and Hudson.
Dark sand	20	80	
Gray lime	638	718	
White sand	9	727	About base of Hudson.
Gray lime	113	840	Trenton.
Pencil cave	5	845	
Black lime	55	900	

These Russell county wells show an almost uniform thickness of about 680 feet for the Hudson (including probably a little Upper Silurian at the top) and a bed of light sand about at

the top of the Trenton group. A pencil cave is shown in all of them but No. 3, which does not go deep enough to reach it. This pencil cave is quite probably the one at the top of the Birdseye member of the Trenton group, the rocks between it and the light sand above representing the Trenton (Bluegrass) limestones of Central Kentucky. These show a remarkable variation in thickness in this group of wells, varying from 113 feet in No. 5 to 234 feet in No. 2.

Well No. 2 goes down probably entirely through the Trenton group, the last 35 feet being apparently in the Calciferous and corresponding to the deep salt sand found in the McBeath well in Wayne county. This would give here a total thickness to the Trenton group of about 930 feet, or from 100 to 130 feet more than in Central Kentucky, this increased thickness probably being due to the presence here of the Knox dolomite in the base of the Trenton group.

BARREN COUNTY WELLS.

No. 1—B. & K. Nuchols farm.

	Thickness.	Depth.	Geological Formation.
Gravel	3	3	
Dark lime	18	21	
Slate	8	29	Waverly (including Keokuk).
White lime (gas at 105)	141	170	
Blue slate (oil show at 180)	10	180	
Lime shell	2	182	
Black shale	20	202	Devonian Shale.
Blue lime	4	206	
Blue lime	5	211	Probably Niagara Limestone with a little Corniferous at the top.
Gray lime	27	238	
Gray lime (oil show)	2	240	
Blue lime	10	250	
Blue shale	25	275	Niagara Shale.
Blue lime (oil show)	9	284	Clinton.
Light lime	8	292	
Dark lime	200	492	
Lime and shale	248	740	Hudson.
Dark lime	30	770	
Dark lime	10	780	
Light lime	75	855	
Blue lime (oil show)	80	935	Hudson and Trenton.
Sandy lime	6	941	
Sandy lime	6	947	
Shells and slate	20	967	
White lime (gas at 1,025)	150	1,117	Trenton.
Dark lime	119	1,236	
Pink lime	60	1,296	

No. 2—J. M. Hammer farm.

	Thickness.	Depth.	Geological Formation.
Gravel	5	5	
Gray lime	12	17	
Dark shale and flinty shells	3	20	
Dark lime	10	30	
Dark lime and shale	20	50	Keokuk and Waverly.
Gray lime (gas at 80)	30	80	
Light lime (gas 90-130)	60	140	
Light lime	25	165	
Light lime (strong gas at 170)	15	180	
Slate and shells	25	205	
Black shale	30	235	Devonian Shale.
Dark lime (oil and salt water at 240)	50	285	Corniferous and Niagara Limestones.
Light slate	30	315	Niagara Shale.
Light lime	200	515	
Shells and shale	150	665	Hudson. Possibly some Clinton at top.
Dark lime	165	830	

No. 3—W. E. Peden farm.

Gravel	13	13	
Gray lime	50	63	Keokuk and Waverly.
Blue shale	10	73	
Lime shell	2	75	
Black shale	25	100	Devonian Shale.
Dark lime	10	110	
Dark lime shells	10	120	Corniferous and Niagara Limestones.
Dark lime (oil show at 125)	15	135	
Blue slate	25	160	Niagara Shale.
Blue lime	10	170	Clinton.
Blue lime (oil show at 178)	8	178	
Blue lime	147	325	
Gray lime	60	385	
Gray lime	20	405	Hudson.
Lime and slate (gas at 530 and 555)	180	585	
Dark lime (heavy gas flow at 585)	75	660	
Dark lime (gas at 685)	25	685	Hudson and Trenton.
Blue lime	150	835	Probable top of Trenton.
White lime	100	935	
White slate	6	941	
Gray lime	125	1,066	Trenton.
Dark lime	18	1,084	About top of Birdseye.
Light lime	100	1,184	
Dark lime	466	1,650	

In No. 1 and No. 3, the lower numbers belong to rocks in the Trenton Period, the space between Black Shale and the base of the Trenton thickening somewhat from the Cumberland river northward. The wells did not get down to the Calciferous. In No. 1, the division between Trenton and Hudson seems to be at 947 and the top of the Birdseye at 1,236. In No. 3, the division between Hudson and Trenton at 835 and top of Birdseye at 1,084. These divisions, however, can not be made with certainty. No. 3 is about down to, or possibly below, the base of the Chazy.

Old Haven-Chase wells.

	Top of Black Shale.	Oil sand at	Product.	Formation.
North well	230	307	Green oil	Niagara.
West well	225	120	Amber oil	Waverly.
South well	228	120	Amber oil	Waverly.
East well	225	360	Green oil	Niagara.
Southeast well	185	310	Green oil	Niagara.
Southwest well	225	130	Gas	Waverly.

These wells all start below the base of the St. Louis Group.

Old Carroll wells.

	Depth.	Oil sands at	Product.
No. 1	875	819	Gas.
No. 2	355	355	Green oil.
No. 3	1,135	100, 715 and 1,135	Amber oil, gas, gas.
No. 4	750	750	Gas.
No. 5	1,166	110 and 1,166	Amber oil, gas.

Group of South Kentucky Oil Co. wells.

No. 1.

Soil	8	8
Waverly	67	75
Black Shale	30	105
Niagara	36	141
Clinton	20	161

No. 2.

Waverly	187	187
Black Shale	33	220
Niagara	20	240
Clinton	20	260

Oil and gas at 240.
Salt water at 254.

No. 3.

Waverly	148	148
Black Shale	32	180
Niagara	46	226
Clinton	20	246

Oil and gas at 226.
Salt water at 230.

No. 4.

Waverly	130	130
Black Shale	36	166
Niagara	36	202
Clinton	29	231

Water and oil at 202.

No. 5.

Waverly	198	198
Black Shale	32	230
Niagara	19	249
Clinton	29	278

Oil and gas at 249.

No. 6.

Waverly	150	150
Black Shale	30	180
Niagara	37	217
Clinton	20	237

Gas at 180.
Oil at 217.

The driller's distinctions of Niagara and Clinton in the last six records are not correct. The records of deeper wells show an average of about 40 feet of limestone, with a hard ledge in the middle, below the Black Shale, and a bed of light-colored shale under that and another oil-bearing limestone under the light-colored shale. This latter would be the Clinton lime, the light shale the Niagara Shale, and what is given above in the records as Niagara and Clinton would be mostly Niagara limestone, with probably a little Corniferous limestone at the top just under the Black Shale.

Boyd's Creek wells.

No. 1.

	Thickness.	Depth.
Waverly	58	58
Black Shale	18	76

Top of first sand at 80.
Gas and salt water at 87².
Top of second sand at 175.
Bottom of second sand at 205.
Bottom of well at 209.

No. 2.

Waverly	58	58
Black Shale	27	85
Oil and gas	87² to 97²	

Bottom of well at 110.

No. 3.

Waverly	55	55
Black Shale	15	70

Oil and gas at 70, 165 and 230.
Bottom of well at 241.

No. 4.

Waverly	58	58
Oil at 37.		
Black Shale	32	90

Gas and oil at 145.
Salt water at 156.
Bottom of well at 201.

No. 5.

	Thickness.	Depth.
Waverly	55	55
Black Shale	35	90

Gas at 135.
Bottom of well at 180.

No. 6.

Waverly	70	70
Black Shale	25	95

Oil and gas at 90 and 135.
Bottom of well at 265.

No. 7.

Waverly	73	73
Black Shale	41	114

Oil at 116.
Bottom at 205.

No. 8.

Waverly	112	112
Black Shale	38	150

Amber oil at 84.
Bottom at 168.

No. 9.

Waverly	68	68
Black Shale	33	101

Oil at 225.
Bottom at 272.

No. 10.

	Thickness.	Depth.	Geological Formation.
Soil	6	6	Waverly.
Lime	36	42	
Black shale	34	76	Devonian.
Lime	64	140	
Sand	20	160	1st Sand—Clinton (?)
Gray lime	90	250	
Slate	10	260	
Lime and shells	15	275	
Hard sand	5	280	
Lime	110	390	
Slate	5	395	
Lime	85	480	
Sand	20	500	2d Sand—Hudson.
Slate	147	647	
Mixed slate	25	672	
Slate	40	712	
Slate and lime	45	757	Bottom in Hudson.

The Barren county fields show a number of sands in downward succession. The first of any importance is the one in the Waverly, about 100 feet above the top of the Black Shale. This has produced amber oil at a number of places, but the record seems to give it but a short life as a producer, the wells soon giving out. The Black Shale itself often produces gas and oil of a very rank, sulphurous character and rather a detriment to the field when struck, than otherwise. The next sand below is found immediately under the Black Shale in a limestone which is probably the Corniferous.

The next lower and, so far, the main producing sand of the county, is the Boyd's Creek sand found at an average of probably 40 feet below the Black Shale (this distance below varies with the varying thickness of the limestone) in a limestone. This limestone is generally divided in the middle by a very hard ledge and the upper half has heretofore been called Niagara and the lower half Clinton. That this is an error will be made evident by inspection of the records of No. 1, No. 2 and No. 3 on pages 126 and 127, where the true position of the Clinton is shown under the Niagara shale. The producing rock is really the Niagara limestone, instead of Clinton. This horizon, while rarely furnishing large wells, seems to be a long-lived producer, wells in it having a record of producing oil, without much decrease, for twenty-five or thirty years.

Below the Boyd's Creek sand, oil and gas shows have been struck in the Clinton, the Hudson and the rocks comprising the Trenton period, as inspection of the preceding records will show. So far, the deeper sands have produced mostly gas, and the Boyd's Creek sand (Niagara limestone) remains the principal oil producer.

WARREN COUNTY WELL.

Well at Bowling Green.

	Depth.	Geological Formation.
At	0—White oolite.	Well starts in St. Louis.
"	18, 25 and 30—Gray lime.	
"	36—Light gray oolite.	
"	42—Fine-grained, white lime.	
"	46 to 70—Very fine-grained, white, siliceous lime.	
"	77—Fine-grained, slightly oolitic, gray lime.	
"	90—Gray lime.	
"	94—Light gray and white limes mixed.	
"	98—Light gray lime.	
"	100—White lime.	
"	106—Light brown lime.	
"	112—Light, mottled lime.	
"	117—Gray lime and white calcite.	
"	130—Fine-grained, gray lime.	
"	135—Gray lime.	
"	140—Gray, crystalline lime.	
"	144—Fine-grained, light gray lime.	
"	156 to 170—Light gray lime; sulphur water.	
"	183—Dark gray lime.	
"	189—Gray lime shale.	
"	195—Dark gray lime.	
"	205—Very dark, gray lime.	
"	210 to 230—Gray lime.	
"	235—Black lime and light gray lime.	
"	240—Dark gray lime.	
"	253—Light brown, sandy lime.	
"	255 and 260—Gray lime.	
"	265—Very dark lime.	
"	270—Brown lime.	
"	278 and 284—Dark gray lime.	
"	287—Brown lime.	
"	288 and 290—Gray lime.	
"	294 and 300—Light gray lime.	Probable base of St. Louis and top of Keokuk.
"	305—Dark gray and white lime mixed.	
"	310—Dark gray lime.	
"	315—Light gray lime and white flint.	
"	325—Very dark lime.	
"	330—Very dark and white lime, mixed.	
"	340—Gray lime and sand.	
"	348—Gray lime.	
"	350—Gray, fossiliferous lime,	
"	358 to 380—Gray lime. Oil at 363 feet.	
"	400 to 420—Hard, gray, lime shale.	
"	425—Dark gray lime.	
"	430—Gray and white limes, mixed.	
"	435—Gray lime and white, lime shale.	
"	440 and 445—Hard, dark, lime and shale.	
"	450—Gray lime and shale.	
"	455—Gray and white limes, mixed.	
"	460—Hard, gray, lime shale and white sand.	

Depth.	Geological Formation.
At 465—Gray lime and lime shale.	
" 470—Gray and white, mottled lime.	
" 475—Gray lime.	
" 485—Dark gray lime and white, lime shale.	
" 490 and 495—Hard, dark, limy shale.	
" 501—Hard, dark, lime shale and white sand.	
" 506—Dark gray lime and hard, lime shale.	
" 510—Light gray lime.	
" 515—Gray lime and lime shale.	
" 520 to 530—Hard, gray, lime shales.	
" 535 to 665—Very dark, hard, impure limestones and lime shales.	
" 670 to 680—Black shale.....	Top of Black Shale at 670.
" 685—Very dark, lime shale.	
" 690—Brown, impure lime.	
" 695 and 700—Very dark, impure lime.	
" 705—Mixed gray and white lime.	
" 708 to 760—Black shale.....	Base of Black Shale at 760.
" 765 and 770—Dark brown, sandy lime.	
" 775—Mixed black and white limes and gray, porous sandy lime.	
" 780—Fine-grained, white lime.	
" 785—Fine-grained, yellow lime.	
" 790—Fine-grained, yellowish-brown lime.	
" 795 to 875—Fine-grained, white lime.	
" 880—Gray and white lime, mixed.	
" 885 and 890—Gray lime.	
" 895 and 900—Very light lime.	
" 910—Gray lime.	
" 915 to 935—Light lime.	
" 940—Mottled, red lime.	
" 945 and 950—Gray lime.	
" 955—Fine-grained, light lime.	
" 960—Gray lime.	
" 965 and 975—Gray and white limes, mixed.	
" 980—Light lime.	
" 985—Gray lime and shale.	
" 990—Mottled, gray and white lime.	
" 995 to 1,010—Gray lime.	
" 1,015—Dark gray lime.	
" 1,020 and 1,025—Light lime.	
" 1,030 to 1,095—Gray limes and shales.	
" 1,100 to 1,130—Light lime.	
" 1,135—Gray lime.	
" 1,140—Gray and white limes, mixed.	
" 1,145—Fine-grained, light lime.	
" 1,150—Light, siliceous lime.	
" 1,155 and 1,160—Light lime.	
" 1,165—Light and dark gray limes, mixed.	
" 1,170 and 1,175—Gray lime.	
" 1,180 and 1,185—Gray lime and dark shale.	
" 1,190—White lime.	
" 1,195 and 1,200—Gray lime.	
" 1,205—Gray lime and shale.	
" 1,210—Gray lime.	
" 1,215 to 1,230—Gray, crystalline lime.	
" 1,235—Fine-grained, gray lime.	
" 1,240—Gray lime.	

Depth.	Geological Formation.
At 1,245—Gray and white limes, mixed.	
" 1,250 to 1,260—Gray lime.	
" 1,265 to 1,290—Dark gray lime.	
" 1,295 to 1,305—Gray lime.	
" 1,310—Hard, dark gray, lime shale and white lime, mixed.	
" 1,315 and 1,320—Gray and white lime, mixed.	
" 1,325—Gray lime.	
" 1,330 to 1,375—Dark gray lime.	
" 1,380 to 1,395—Very dark gray lime.	
" 1,400 and 1,405—Gray lime.	
" 1,410—Dark gray lime.	
" 1,415—Dark gray lime and black shale.	
" 1,420—Dark gray and white limes, mixed.	
" 1,425—Hard, dark, lime shale.	
" 1,430 to 1,440—Gray lime.	
" 1,445—Black and white limes, mixed.	
" 1,450—Dark gray lime.	
" 1,455 and 1,460—Gray and white limes, mixed.	
" 1,465—Brown lime.	
" 1,470—Dark gray lime.	
" 1,475—Very dark gray lime.	
" 1,480—Gray lime.	
" 1,490—Very dark gray lime.	
" 1,495 to 1,520—Gray and white limes, mixed.	
" 1,525 to 1,550—Dark gray lime.	
" 1,555—Gray and white lime, mixed.	
" 1,560 and 1,590—Dark gray lime.	
" 1,595—Gray lime.	
" 1,600 and 1,605—Light lime.	
" 1,610 to 1,630—Very dark lime.	
" 1,635 to 1,660—Light and dark limes, mixed.	Top of Birdseye.
" 1,660 to 1,670—Light, dove-colored lime.	
" 1,685—Gray lime.	
" 1,685 to 1,690—Light lime.	
" 1,695—Light, mottled lime.	
" 1,700—Light lime.	
" 1,705 to 1,715—Dark gray and light limes.	
" 1,720—Very dark lime.	
" 1,725 and 1,730—Very dark and light limes, mixed.	
" 1,735—Black lime.	
" 1,740 and 1,745—Very dark, brownish lime.	
" 1,750—Black lime.	
" 1,755—Very dark, brown lime.	
" 1,760—Gray lime.	
" 1,765—Dark gray lime.	
" 1,770—Very dark lime.	
" 1,775—Gray lime.	
" 1,780—Very dark lime.	

The well starts in the St. Louis Group and goes down to about the top of the Chazy. The lines between St. Louis and Keokuk and between the Hudson and Trenton can not be drawn with accuracy. The base of the St. Louis is about at 230. The top of the Black Shale is at 670 and its base at 760, giving a thickness of about 430 for Keokuk and 90 for the Black Shale. The Black Shale is divided in two parts by a bed of dark, impure lime and shales. The top of the Trenton Group can be put approximately at 1,415 and the top of the Birdseye at 1,660.

LOGAN COUNTY WELL.

Partial record of well at Russellville.

At 744—"Blue Lick" water.
910 to 1,010—Shale.
Trenton rock (?).
Heavy oil at 1,291.
Marble, 1,291 to 1,411.
Dark, pebbly rock, 1,411 to 1,854.

HART COUNTY WELLS.

No. 1—Dog Creek.

	Thickness.	Depth.	Geological Formation.
Drift	12	12	Chester.
Gray lime	26	38	
Coal	½	38[2]	
Blue fire clay	25½	64	
Hard lime	10	74	
Blue fire clay	34	108	
Gray lime	50	158	St. Louis Group.
Dark lime	70	228	
Light gray lime (salt water)	50	278	
Light gray sand	25	303	
Light gray lime	40	343	
Dark gray lime	31	374	
Dark gray sand	24	398	
Dark gray lime	45	443	
Light gray lime	75	518	
Dark gray sand	54	572	
Light gray lime	30	602	
Red lime	40	642	
Very dark lime	93	735	Keokuk and Waverly.
Dark, bastard sand (oil show)	12	747	
Dark gray lime	178	925	
Hard, dark, bastard sand	42	967	
Very dark lime	138	1,105	
Lead-colored slate	5	1,110	
Black shale	105	1,215	Devonian Shale.
Hard, dark gray lime	15	1,230	Corniferous (?)
Light gray lime	10	1,240	Boyd's Creek Sand.
Open sandy streak (oil and gas)	18	1,258	
Dark gray lime	9	1,267	Upper Silurian.
Very dark lime	5	1,272	
Dark, sandy lime	8	1,280	
Light, sandy lime (oil show)	10	1,290	Probably Clinton.
Soft, light gray lime	40	1,330	Hudson.

No. 2—Dog Creek.

	Thickness.	Depth.	Geological Formation.
Drift	9[2]	9[2]	Chester.
Hard, gray lime	55[2]	65	
Bluish fire clay	4	69	
Dark gray lime	1	70	
Dark gray sand	20	90	
Coal	½		
Bluish fire clay	11½	102	
Hard, bluish-gray lime	28	130	
Hard, gray sand	7	137	
Coal	½		
Lead-colored fire clay	9½	147	
Gray, bastard sand	12	159	
Lead-colored fire clay	27	186	
Dark gray lime	14	200	
Light gray lime	5	205	
Coal	½		
Lead-colored fire clay	3½	209	
Light gray lime	10	219	
Dark fire clay	3	222	
Light gray lime	33	255	St. Louis Group.
Dark gray lime	75	330	
Light gray lime	35	365	
Dark gray lime	35	400	
Dark gray lime	13	413	
Light gray lime	57	470	
Brownish-gray lime	35	505	
Hard, gray sand	20	525	
Gray lime	50	575	
Dark gray lime	25	600	
Light gray lime	22	622	
Dark, bastard lime	178	800	
Dark gray lime—black streaks	15	815	Keokuk and Waverly.
Bastard lime and sand	25	840	
Black, bastard lime	80	920	
Hard, dark gray sand	30	950	
Very dark, bastard lime	50	1,000	
Black, bastard slate	40	1,040	
Black, bastard lime	173	1,213	
Black shale	105	1,318	Devonian Shale.
Hard, gray sand	10	1,328	Corniferous.
Black slate	6	1,334	
Gray, hard sand	2	1,336	
Light gray sand	23	1,359	Boyd's Creek Sand.
Dark gray sand	6	1,365	
Hard, bastard sand	6	1,371	
Hard, bastard lime	25	1,396	
Hard, gray sand	24	1,420	
Reddish gray sand	10	1,430	
Light, open sand (strong salt water)	17	1,447	

In these two records, the division lines between St. Louis and Keokuk are uncertain.

BRECKENRIDGE COUNTY WELLS.

No. 1—Cloverport.

	Thickness.	Depth.	Geological Formation.
Soil	12	12	Chester to 145.
Brown marl	20	32	
Blue marl	26	58	
Gray lime	30	88	No. 1 Chester Limestone.
Blue shale	1	89	
Gray lime	2	91	
Blue shale	11	102	
Brown marl	11	113	
White sand	32	145	No. 1 (Big Clifty) S. S.
Blue shale	38	183	St. Louis Group.
Fossil lime	2	185	
Blue shale	6	191	
Lime	7	198	
Shale	36	234	
Lime	28	262	
Shale	18	280	
Lime	20	300	
Dark shale	8	308	
Lime	15	323	
Shale	6	329	
Lime	60	389	
Shale	12	401	
Lime (sulphur water)	55	456	
Shale	4	460	
Lime (salt water)	93	553	
Sand	20	573	
Lime (oil shows)	285	858	
Lime	14	872	Keokuk L. S.
Gray, porous lime (gas)	15	887	
Blue lime.			

No. 2—Webster.

Lime	895	895	St. Louis and Keokuk.
Black shale	75	970	Devonian.

No. 3—Hardinsburg.

Soil	17	17	Chester.
Limestone	35	52	
Sandstone	57	109	
Limestone	25	134	
Sandstone	76	210	
Mostly limestone	735	945	St. Louis.
Limestone and shale (gas at 1,055)	435	1,380	Keokuk and Waverly.
Black shale	95	1,475	Devonian.
Limestone	20	1,495	Probably Corniferous and Niagara.

No. 4—Stephensport.

	Depth.	Geological Formation.
At	0 to 22—Soil.	
"	22 to 25—Gray shale.	
"	25 to 35—Gray lime	No. 1 Chester Limestone.
"	32 to 67—Light brown sand	Big Clifty Sandstone.
"	75—Gray, crinoidal limestone	Top of St. Louis at 67.
"	85—Gray lime.	
"	96—White lime.	
"	100—Mottled, gray lime.	
"	130—Black shale.	
"	135—Light, dove-colored lime.	
"	155—Soft, white lime.	
"	230—Gray lime and pink, crystalline lime.	
"	240—Gray oolite.	
"	276—Dove-colored, lithographic lime.	
"	300—Light gray, partly oolitic lime.	
"	317—Gray and white, crinoidal limes.	
"	335—White lime.	
"	350—Gray, crystalline lime.	
"	380—Fine-grained, white lime.	
"	395—White lime.	
"	420—Light gray lime.	
"	425—Black shale—crinoidal lime—sand, mixed.	
"	435—Light and dark gray limes.	
"	450—Gray lime.	
"	470—Very light lime.	
"	475—Dark gray lime.	
"	482—Brownish-gray lime and black shale, mixed.	
"	500—Brown lime and black shale over a light gray, crinoidal lime.	
"	510—White quartzite.	
"	515—Dove-colored lime.	
"	518—Gray, fossiliferous and black limes.	67 to 813—Full section of St. Louis Group.
"	525—Gray lime.	
"	530—Black lime.	
"	535—Thin, gray limes.	
"	540—Black lime.	
"	555—Gray lime.	
"	585—Dove-colored lime.	
"	600—Black lime.	
"	620—Light, mottled lime.	
"	630—Dark gray lime.	
"	638—White quartzite.	
"	644—Dark, dove-colored lime.	
"	650—Soft, brownish-white, shaly lime over brown lime.	
"	656—Gray lime.	
"	662—Dark gray lime.	
"	680—Brownish-gray lime.	
"	686—Dark and light gray limes.	
"	692—Light gray lime.	
"	700—White lime.	
"	712—Dark gray lime.	
"	722—Brownish-white lime.	
"	735—Dark gray, crystalline lime.	
"	755 to 807—Dark gray lime.	
"	813—Light and dark gray limes.	
		Base of St. Louis and top of Keokuk.

Depth.		Geological Formation.
At	816—Black shaly lime.	
"	835—Black lime—white fossils.	
"	840—Black lime.	
"	865—White, fossiliferous lime.	
"	890—Mottled, gray lime and white lime.	
"	900—Dove-colored lime.	
"	915—Very light lime.	813 to 1,253—Full section of Keokuk.
"	1,030—Light gray lime.	
"	1,045—Gray, crystalline lime.	
"	1,050 to 1,100—Light gray lime.	
"	1,124—Gray, sandy lime.	
"	1,130—Gray lime.	
"	1,138—White and dark gray limes.	
"	1,150—Very dark lime.	
"	1,155 to 1,185—Impure, black lime.	
"	1,230—Fine-grained, black, limy sandstone.....	Base of Keokuk.
"	1,253 to 1,315—Black shale.	Devonian.

This well did not go quite deep enough to test the Boyd's Creek Sand.

Well at Tell City, Indiana—Below Hawesville, Hancock Co., Ky.

	Thickness.	Depth.	Geological Formation.
Soil	25	25	Lower Coal Measures.
Gray shale	15	40	
Light gray sand	40	80	
Very dark, very fine-grained sand.	80	160	
Gray and white limestone	30	190	Full section of Chester Group.
Very dark, gray shale	30	220	
Space	10	230	
Light, yellowish-brown lime	5	235	
Grayish-green marl	45	280	
Dark gray lime	30	310	
Light gray lime	41	351	
Gray, slightly calcareous sand	6	357	
Mottled, gray lime and dark gray shale	43	400	
Gray sand, slightly calcareous	15	415	
Dark gray shale	81	496	
Red and brown marl	35	531	
Light gray lime	33	564	
Dark gray shale	36	600	
Light gray sand	20	620	
Black and white lime and black shale	3	623	
Gray lime	17	640	
Reddish-brown marl	13	653	
Gray sand	27	680	
Reddish-brown marl	5	685	
Light gray sand	62	747	
Space	10	757	
Gray lime	168	925	St. Louis.
Fine-grained, light lime	5	930	
Very fine-grained, light lime	240	1,170	

Well stopped in St. Louis limestone.

Eugene Young well—Three miles northeast of Fredonia, Caldwell Co.

	Thickness.	Depth.
Soil	15	15
Slate and lime	10	25
Hard, black lime	25	50
Slate	25	75
Soft, gray sand	10	85
Slate and shaly, white sand	40	125
Soft, white sand	50	175
Red soapstone	10	185
Sand	55	240
Slate	60	300
Lime (black sulphur water)	25	325
Slate and soapstone	75	400
Slate and hard, shaly lime	40	440
Hard, light lime	50	490
Sand and slate	30	520
White quartzite	55	575
Sand	25	600
Lime	35	635
Slate	15	650
Hard lime	15	665
Pink rock—slate or soapstone	15	680
Bluish lime	220	900
Hard, sharp lime	90	990
Hard sand	10	1,000
Lime	10	1,010
Sand	10	1,020
Lime	15	1,035
Sand	265	1,300
Blue and black, hard limes	1,044	2,344

Flinty in lower beds.

Well began in the Chester series. At 740 salt water was struck. The Black Shale does not show in the record.

CARROLL COUNTY WELL.

Well at Carrollton.

Depth.		Geological Formation.
From 0 to 96—	Alluvium.	Alluvial.
At	96—Light, crystalline lime.	Trenton Limestones.
"	180—Light and dark, gray limes.	
"	200—Light, crystalline lime.	
"	230—Light brown, conglomerate lime.	
"	242—Light, magnesian lime.	
"	260—Gray, magnesian lime.	
"	280—Fine-grained, gray lime.	
"	285—Fine, light, magnesian lime.	
"	335—Light, crystalline and gray, fossil lime.	
"	420—Birdseye limestone.	Birdseye.
"	430—Birdseye limestone.	
"	475—Birdseye lime and some magnesian lime.	
"	495—Light, magnesian lime.	Magnesian.
"	500, 520, 600, 675, 700 and 800—Chazy limestone.	Chazy.
"	1,000—A greenish-black slate and top of Calciferous.	
"	1,095—Calciferous.	Calciferous.
"	1,148—Calciferous ("Blue Lick" water).	

The top of the Trenton is below low water in the Ohio river. The top of the Birdseye is between 335 and 420—probably about at 400—and the base at 475. The Magnesian limestone shows at from 475 to 495, and the Chazy at 500 to 1,000. The top of the Calciferous is at 1,000. The well stopped in the Calciferous, with a flow of "Blue Lick" water at 1,148 feet.

OLDHAM COUNTY WELL. (Partial Record.)

Well at LaGrange.

Depth.	Geological Formation.
At 790—Gray limestone	Top of Trenton about 675.
" 835—Very dark gray lime.	
" 930—Light, dove-colored lime	Top of Birdseye about 900.
" 1,025—Dark, dove-colored lime.	
" 1,225—White lime.	
" 1,260—Dove-colored lime.	
" 1,315 to 1,365—Very dark, dove-colored lime.	
" 1,380—Dove-colored lime.	
" 1,450—"Blue Lick" water.	
" 1,450 to 1,555—Light sandy lime.	(Top of Calciferous between 1,380 and 1,450.)
Well starts about at top of Hudson.	

HARRISON COUNTY WELL.

Well at Cynthiana.

	Thickness.	Depth.	Geological Formation.
Soil	24	24	
Dark gray lime at		24	
Dark and light gray lime	52	76	
Light, very fine-grained lime	19	95	
Sulphur water at		74	
Mixed gray limestones	55	150	
Very dark gray lime at		175	
Light, dove-colored lime at		215 to 300	Birdseye.
Very light lime at		350 to 600	Chazy.
Very dark, dove-colored lime		670 to 690	Chazy.
Light, greenish shale at		760	Top of Calciferous.
Light, sandy lime at		785 to 1,000	
Bottom at 1,000.			

Well starts near top of Trenton.

Bottom of Trenton (Bluegrass) limestones	215
Birdseye	215 to 300
Chazy	320 to 760
Calciferous	760 to Bottom

WEBSTER COUNTY WELLS.

Well at Sebree.

	Thickness.
Clay and sand	52
Soft sandstone	6
Soapstone and clay	66
Sandrock	8
Soft sandstone	50
Slate	33

Sebree well—Continued.

	Thickness.	
Coal	1½	
Fire clay	5	
Limestone	8	
Sandy shale	27	
Slate	6	
Coal	3½	
Soapstone and shale	40	
Sandrock	29	
Sandy shale	75	
Soapstone	15	
Sandstone	15	
Soapstone	20	
Sandy shale	5	
Black shale	28	
Hard lime	2	
Coal	3	
Soapstone	24	
Sandrock	6	
Soapstone	2	
Sandrock with soft stratas	62	Oil, Salt Water and Gas.
Soapstone	3	
	695	

Well at Lisman Station.

	Thickness.	Depth.
Clay	22	22
Soapstone	23	45
Bastard limestone	10	55
Coal	1	56
Sandstone, soapstone and slate	27	83
Bastard limestone	10	93
Sandstone and shale	33	126
Soapstone	27	153
Black slate	10	163
Sandstone and sandy shale	10	173
Sandstone	10	183
Bastard limestone	15	198
Soapstone	30	228
Sandstone	7	235
Soapstone	49	284
Black slate	3	287
Fire clay and slate	4	291
Sandy shale	22	313
Gray sand and lime	5	318
Black slate	5	323
Coal	1²	324
Limestone	3	327
Gray sandstone	8	335
Limestone	23	358
Soapstone	21	379
Gray sandstone	8	387
Soapstone	11	398

WELL AT CENTRAL CITY, NEAR HUNTINGTON, W. VA.

(Prof. White.)

	Thickness.	Depth.
Conductor	26	26
Shale, sand and lime	94	120
Lime	7	127
Slate and fire clay	98	225
Sand (Upper Mahoning—Dunkard)	25	250
Slate	50	300
Sand (Lower Mahoning) gas	30	330
Black slate (Upper Freeport coal)	10	340
Gray sand	60	400
Black slate	10	410
Gray sand	85	495
White and blue slate	25	520
Sand and lime	20	540
Slate	20	560
Black slate	175	735
Gray sand	25	760
Black slate (coal)	105	865
Sand (gas and salt water)	30	895
Black sand	10	905
Black slate	30	935
Lime	5	940
Black slate	30	970
Mountain lime	150	1,120
Slate	28	1,148
Dark gray sand ("Big Injun") salt water	177	1,325
Black shale and slate	370	1,695
Lime and hard sand	10	1,705
Brown slate	25	1,730
Berea sand (oil and gas)	25	1,755
Black slate	10	1,765
Hard gray sand	5	1,770
Lime	5	1,775
Gray sand	10	1,785
Lime	3	1,788
Black sand	2	1,790
Bastard lime	4	1,794
Black shale	20	1,814
Fine black sand	97	1,911
Shale and slate (black, blue and white)	574	2,485
Bastard lime (gas, stray sand)	15	2,500
Shale	250	2,750
Gray sand	10	2,760
Corniferous limestone	10	2,770

CHAPTER VI.

ADDITIONAL WELL RECORDS.

The records of drilled wells given in the preceding chapter were intended to represent, as well as possible, typical records for the respective counties in which they were drilled. Below are given a number of additional records, all of which are authentic and many of them typical, but some of which, owing in some cases to obvious errors of the driller in describing formations passed through, and, in other cases, owing to the rocks presenting a section changed locally from the usual section, may differ somewhat in one or more respects from a typical section and in some parts be difficult to entirely interpret. The records are given just as received from the drillers, but the identification of sands and geological formations are by the writer.

BATH COUNTY WELLS.

No. 1—Ragland farm.	Thickness.	Depth.	Geological Formation.
Gravel	12	12	
Lime	60	72	
Slate	100	172	
White shale	10	182	
Black shale	231	413	Devonian Shales.
Oil sand	21	434	Corniferous.
No. 2—Ragland farm.			
Gravel	22	22	
Blue lime	136	158	
Black shale	205	363	
White fire clay	6	369	Devonian Shales.
Brown shale	9	378	
Oil sand	20	398	Corniferous.
No. 3—Ragland farm.			
Gravel	35	35	
Blue shale	65	100	Waverly.
Brown shale	100	200	
Fire clay	8	208	Devonian Shales.
Shale	14	222	
Oil sand	30	252	Corniferous.
Red mud	206	458	Niagara.
2d sand	22	480	Clinton.
Mud	2	482	

No. 4—Ragland farm.

	Thickness.	Depth.	Geological Formation.
Gravel	17	17	
Blue shale	542	559	Waverly.
Black shale	205	764	Devonian Shales.
White fire clay	8	772	
Brown shale	12	784	
Oil sand	20	804	Corniferous.

No. 5—Ragland farm.

Gravel	20	20	
Blue shale	167	187	Waverly.
Black shale	205	392	Devonian Shales.
White fire clay	8	400	
Brown shale	12	412	
Oil sand	14	426	Corniferous.

No. 6—Ragland farm.

Lime	50	50	St. Louis.
Blue shale	449	499	Waverly.
Black shale	205	704	Devonian Shales.
White fire clay	8	712	
Brown shale	12	724	
Oil sand	17	741	Corniferous.

No. 7—Ragland farm.

Gravel	20	20	
Blue shale	97	117	Waverly.
Black shale	205	322	Devonian Shales.
White fire-clay	8	330	
Brown shale	12	342	
Oil sand	15	357	Corniferous.

No. 8—Ragland farm.

Lime	20	20	St. Louis.
Blue shale	522	542	Waverly.
Black shale	205	747	Devonian Shales.
White fire-clay	8	755	
Brown shale	12	767	
Oil sand	20	787	Corniferous.

No. 9—Ragland farm.

Gravel	20	20	
Blue shale	20	40	Waverly.
Black shale	224	264	Devonian Shales.
White fire-clay	4	268	
Sand	32	300	
Soapstone	4	304	
Stray sand (oil)	18	322	
Shale	3	325	

No. 10—T. C. Ragland farm.

	Thickness.	Depth.	Geological Formation.
Gravel	5	5	
Blue shale	172	177	Waverly.
Black shale	206	383	Devonian Shales.
White fire-clay	5	388	
Brown shale	15	403	
Oil sand	19	422	Corniferous.

No. 11—T. C. Ragland farm.

Gravel	10	10	
Blue shale	362	372	Waverly.
Black shale	205	577	Devonian Shales.
White fire-clay	8	585	
Brown shale	12	597	
Oil sand	18	615	Corniferous.

No. 12—Ragland farm.

Gravel	34	34	
Blue shale	61	95	Waverly.
Brown shale	200	295	Devonian Shales.
White fire-clay	8	303	
Brown shale	12	315	
Oil sand	27	342	Corniferous.

No. 13—Ewing farm.

Gravel	22	22	
Lime	153	175	
White slate	230	405	
Sand	30	435	
Black shale	216	651	Devonian.
Oil sand	29	680	Corniferous.

No. 14—Ewing farm.

Gravel	18	18	
Lime	158	176	
Slate	274	450	
Shale	216	666	Devonian.
Oil sand	24	690	Corniferous.

No. 15—Ewing farm.

Gravel	13	13	
Lime	225	238	
Slate	273	511	
Black shale	215	726	Devonian.
Oil sand	21	747	Corniferous.

No. 16—Ewing farm.

	Thickness.	Depth.	Geological Formation.
Gravel	20	20	
Blue shale	391	411	Waverly.
Black shale	205	616	Devonian Shales.
White fire-clay	8	624	
Brown shale	12	636	
Oil sand	24	660	Corniferous.

No. 17—Ewing farm.

Lime	50	50	St. Louis.
Blue shale	555	605	Waverly.
Black shale	205	810	Devonian Shales.
White fire-clay	5	815	
Brown shale	15	830	
Oil sand	25	855	Corniferous.

No. 18—Ewing farm.

Gravel	4	4	
Lime and shale	395	399	
Black shale	205	604	Devonian Shales.
Fire-clay	8	612	
Shale	12	624	
Oil sand	25	649	Corniferous.

No. 19—Ewing farm.

Blue shale	590	590	Waverly.
Black shale	206	796	Devonian Shales.
White fire-clay	5	801	
Brown shale	15	816	
Oil sand	25	841	Corniferous.

No. 20—Ewing farm.

Gravel	40	40	
Blue shale	662	702	Waverly.
Black shale	206	908	Devonian Shales.
White fire-clay	6	914	
Brown shale	14	928	
Oil sand	25	953	Corniferous.

No. 21—Ewing farm.

Gravel	20	20	
Blue shale	527	547	Waverly.
Black shale	205	752	Devonian Shales.
White fire-clay	8	760	
Brown shale	12	772	
Oil sand	22	794	Corniferous.

No. 22—Ewing farm.

	Thickness.	Depth.	Geological Formation.
Lime	50	50	St. Louis.
Blue shale	565	615	Waverly.
Black shale	205	820	Devonian Shales.
White fire-clay	8	828	
Brown shale	12	840	
Oil sand	33	873	Corniferous.

No. 23—Ewing farm.

Lime	50	50	St. Louis.
Blue shale	569	619	Waverly.
Black shale	205	824	Devonian Shales.
White fire-clay	8	832	
Brown shale	12	844	
Oil sand	34	878	Corniferous.

No. 24—Wooley farm.

Gravel	2	2	
Sand	155	157	Waverly.
Black shale	113	270	Devonian.
Ragland sand	24	294	Corniferous.
Light shale	220	514	Niagara.
2d sand	83	597	Clinton (in upper part)
Slate	18	615	Hudson.

No. 25—Wooley farm.

Gravel	12	12	
White lime	56	68	
White slate	89	157	
White lime	90	245	
Brown shale	10	255	Devonian Shales.
White slate	10	265	
Black shale	200	465	
Oil sand	22	487	Corniferous.

No. 26—Wooley farm.

Gravel	6	6	
White lime	264	270	
Brown shale	20	290	Devonian Shales.
White slate	20	310	
Brown shale	162	472	
White slate	12	484	
Brown shale	6	490	
Oil sand	19	509	Corniferous.

No. 27—Wooley farm.

	Thickness.	Depth.	Geological Formation.
Gravel	18	18	
White shale	280	298	Waverly.
Black shale	190	488	Devonian Shales.
Fire-clay	10	498	
Black shale	15	513	
Oil sand	22	535	Corniferous.

No. 28—Wooley farm.

Gravel	10	10	
White lime	298	308	
Black shale	207	515	Devonian Shales.
Brown shale	10	525	
Fire-clay	5	530	
Oil sand	19	549	Corniferous.

No. 29—Wooley farm.

Gravel	8	8	
White shale	347	355	Waverly.
Black shale	209	564	Devonian Shales.
Fire-clay	8	572	
Oil sand	21	593	Corniferous.

No. 30—Wooley farm.

White lime	50	50	St. Louis.
Blue shale	508	558	Waverly.
Black shale	206	764	Devonian Shales.
White fire-clay	6	770	
Brown shale	13	783	
Oil sand	22	805	Corniferous.

No. 31—Wooley farm.

Blue shale	557	557	Waverly.
Black shale	206	763	Devonian Shales.
White fire-clay	6	769	
Brown shale	14	783	
Oil sand	24	807	Corniferous.

No. 32—Wooley farm.

Blue shale	284	284	Waverly.
Black shale	205	489	Devonian Shales.
White fire-clay	6	495	
Brown shale	13	508	
Oil sand	22	530	Corniferous.

No. 33—Wooley farm.

	Thickness.	Depth.	Geological Formation.
Blue shale	298	298	Waverly.
Black shale	207	505	Devonian Shales.
White fire-clay	7	512	
Brown shale	14	526	
Oil sand	20	546	Corniferous.

No. 34—Wooley farm.

Blue shale	550	550	Waverly.
Black shale	207	757	Devonian Shales.
White fire-clay	6	763	
Brown shale	14	777	
Oil sand	26	803	Corniferous.

No. 35—Wooley farm.

Blue shale	307	307	Waverly.
Black shale	207	514	Devonian Shales.
White fire-clay	6	520	
Brown shale	14	534	
Oil sand	15	549	Corniferous.

No. 36—Wooley farm.

Gravel	10	10	
Lime	40	50	
Blue shale	492	542	Waverly.
Brown shale	205	747	Devonian Shales.
White fire-clay	8	755	
Brown shale	12	767	
Oil sand	22	789	Corniferous.

No. 37—Wooley farm.

Lime	50	50	
Blue shale	488	538	Waverly.
Black shale	205	743	Devonian Shales.
White fire-clay	8	751	
Brown shale	12	763	
Oil sand	21	784	Corniferous.

No. 38—Wooley farm.

Lime	80	80	St. Louis.
Blue shale	533	613	Waverly.
Black shale	205	818	Devonian Shales.
Fire-clay	8	826	
Brown shale	12	838	
Oil sand	20	858	Corniferous.

No. 39—Wooley farm.

	Thickness.	Depth.	Geological Formation.
Gravel	20	20	
Lime	40	60	St. Louis.
Blue shale	515	575	Waverly.
Black shale	205	780	Devonian Shales.
White fire-clay	8	788	
Brown shale	12	800	
Oil sand	26	826	Corniferous.

No. 40—Wooley farm.

Lime	40	40	St. Louis.
Blue shale	511	551	Waverly.
Black shale	205	756	Devonian Shales.
White fire-clay	8	764	
Brown shale	12	776	
Oil sand	21	797	Corniferous.

No. 41—Wooley farm.

Gravel and blue shale	226	226	Waverly.
Black shale	205	431	Devonian Shales.
White fire-clay	8	439	
Brown shale	12	451	
Ragland sand	18	469	Corniferous.

No. 42—Wooley farm.

Gravel	6	6	Devonian Shales.
Brown shale	5	11	
Soapstone	20	31	
Shale	140	171	
Soapstone or fire-clay	20	191	
Shale	5	196	
Fire-clay	9	205	
Ragland sand	6	211	Corniferous.
Blue mud	10	221	Niagara (?)
Soft lime	12	233	
Red mud	155	388	
Hard lime	12	400	Clinton (?)
Blue mud	10	410	
2d sand	14	424	
Blue mud	3	427	

No. 43—Wooley farm.

Gravel	20	20	
Blue shale	251	271	Waverly.
Black shale	205	476	Devonian Shales.
White fire-clay	8	484	
Brown shale	12	496	
Oil sand	15	511	Corniferous.

No. 44—McKinney farm.

	Thickness.	Depth.	Geological Formation.
Clay, sand and gravel	20	20	
White shale	120	140	
Brown shale	16	156	Devonian Shales.
Fire-clay and shale	20	176	
Brown shale	176	352	
Oil sand	15[2]	367[2]	Corniferous.

MENEFEE COUNTY WELLS.

No. 1—Hulda Coldiron farm.

Clay	7	7	Waverly.
Dark sand	13	20	
Blue shale	3	23	
Dark sand	5	28	
Blue shale	5	33	
Dark sand	5	38	
Blue shale	4	42	
Dark sand	9	51	
Blue shale	13	64	
Dark sand	6	70	
Blue shale	25	95	
Dark sand	25	120	
Blue shale	310	430	
Gray lime	2	432	
Blue shale	4	436	
Black shale	24	460	Devonian Shales.
Blue shale	6	466	
Brown shale (shale gas at 500)	137	603	
Blue shale	4	607	
Dark lime (gas)	9	616	Corniferous L. S.
Gray lime (gas)	17	633	
Blue shale	2	635	
Dark lime	3	638	
Gray lime	17	655	
Blue shale	2	657	
Gray lime	3	660	
Blue shale	1	661	
Dark lime	3	664	
Gray lime	3	667	
Blue shale	2	669	
Gray lime	3	672	
Blue shale	4	676	

700,000 cubic feet of gas per day.

No. 2—J. M. Adams farm.

	Thickness.	Depth.	Geological Formation.
Clay	7	7	
Dark sand	47	54	Waverly.
Blue shale	288	342	
Gray lime	3	345	
Black shale	159[2]	504[2]	Devonian Shales.
Blue shale	4[2]	509	
Dark lime	16	525	Corniferous L. S.
Gray lime (gas and salt water)	10	535	
Blue shale	10	545	Niagara.
Gray lime	5	550	
Light shale	7	557	

No. 3—Ewing Heirs.

Gravel	15	15	
Blue lime	325	340	
Black shale	230	570	Devonian.
Ragland sand	50	620	
Lime	180	800	
Red rock	25	825	
Lime	150	975	
White slate	25	1,000	
Blue lime	200	1,200	
Red rock	10	1,210	
White lime	300	1,510	
White sand	50	1,560	
White lime	80	1,640	
Sand	20	1,660	
Lime	141	1,801	

No. 4—Agnes Rothwell farm.

Soil	4	4	Waverly.
Dark sandstone	186	190	
Dark lime	2	192	
Blue shale	206	398	
Blue lime	14	412	
Black shale	130	542	Devonian Shales.
Blue shale	2	544	
Black shale	11	555	
Brown shale	6	561	
Blue shale	11	572	
Dark lime	17	589	Corniferous L. S.—Ragland Sand.
Dark gas lime (gas)	15	604	
Dark lime	11	615	
Blue shale	45	660	Niagara Shales.
Dark shale	40	700	
Blue shale	39	739	
Red and brown shale	10	749	
Gray lime	5	754	Top of Clinton.
Blue shale	5	759	
Gray lime	411	1,170	Clinton and Hudson.
Gray lime and fossils	30	1,200	

No. 5—Bellamy farm.

	Thickness.	Depth.	Geological Formation.
Clay	5	5	Waverly.
Blue soapstone	113	118	
Black shale	150	268	Devonian.
Blue shale	62	330	Niagara.
Hard, gray lime	15	345	Clinton and Hudson.
Dark shale	38	383	
Dark lime	232	615	
Gray lime	10	625	
Dark lime	75	700	

No. 6—Davis Hamilton farm.

Clay	8	8	Waverly.
Soft, blue shale	4	12	
Hard, blue shale	11	23	
Black shale	152	175	
Light shale	35	210	
Hard, gray lime	3	213	
Soft, blue shale	2	215	Devonian.
Black shale	143	358	
Blue shale	64	422	
Black slate	18	440	
Blue shale	46	486	Niagara.
Olive green shale	14	500	
Yellow flint	1	501	
Reddish-brown shale	8	509	
Light-green slate	3	512	
Reddish-brown shale	2	514	
Hard, gray lime	11	525	Clinton.
Blue shale	2	527	
Hard, gray lime	3	530	
Blue shale	18	548	
Hard, gray lime	24	572	
Pink shale	2	574	
Hard, gray lime	3	577	
Light shale	8	585	
Hard, gray lime	3	588	
Blue shale	2	590	
Hard, gray lime	4	594	
White shale	6	600	
Blue slate	14	614	
Hard, black lime	103	717	
Gray lime	5	722	
Dark lime	2	724	
Gray lime	1	725	
Blue lime	6	731	
Dark lime (white specks)	83	814	
Green lime	11	825	
Dark gray lime	35	860	
Dark gray lime (fossils)	98	958	
White lime	8	966	
Dark lime	3	969	
Dark gray slate	5	974	
Dark lime	21	995	
Blue slate	3	998	
Dark lime	7	1,005	

No. 7—J. J. Chambers, No. 2.

	Thickness.	Depth.	Geological Formation.
Clay	7	7	
Blue sand	113	120	Waverly.
Blue shale	333[2]	453[2]	
Gray lime	3[2]	457	
Black shale	156	613	Devonian Shales.
White shale	8	621	
Dark lime (gas show at 636) (oil show at 646)	40	661	Corniferous L. S.
Gray lime	15	676	
Salt water sand	12	688	
Gray lime	7	695	
Blue shale	13	708	

No. 8—T. F. Poynter farm.

Soil	7	7	
Gray slate	363	370	Waverly.
Red slate	5	375	
Gray slate	35	410	
Black shale	140	550	Devonian Shales.
Light shale	7	557	
Dark lime	2	559	Corniferous L. S.
Gray lime (gas)	18	577	
Gray shale	13	590	Niagara.

No. 9—R. S. Ingram farm.

Soil	10	10	
Blue slate	10	20	Waverly.
Sandstone	30	50	
Blue shale	48	98	
Hard sandstone	6	104	
Soft sandstone	6	110	
Gray lime	100	210	
Blue lime and slate	187	397	
Black shale	173	570	Devonian.
Dark gas lime (salt water)	30	600	Corniferous.
Gray gas lime	20	620	
Light gas lime (oil show)	10	630	
Blue slate	10	640	
Blue shale	110	750	
Blue slate	20	770	
Pink shale	25	795	
Blue lime	53	848	

No. 10—W. F. Fitzpatrick farm.

Clay	5	5	
Blue shale	30	35	Waverly.
Blue sand	8	43	
Blue shale	264	307	
Gray lime	8	315	
Black shale	143	458	Devonian Shales.
Blue shale	8	466	
Dark gas sand	1	467	Corniferous.
Gray gas sand	10	477	
Dark gas sand	17	494	
Soft, blue shale	19	513	Niagara.

No. 11—Skidmore Bros.' farm.

	Thickness.	Depth.	Geological Formation.
Clay	9	9	
Dark sand	71	80	Waverly.
Blue shale	298	378	
Black shale	156	534	Devonian Shales.
Blue shale	6	540	
Dark gas sand	7	547	Corniferous.
Gray gas sand	26	573	
Dark gas sand	11	584	
Blue shale	6	590	Niagara.

No. 12—J. J. Chambers farm.

Soil	4	4	
Blue sand	176	180	Waverly.
Blue shale	92	272	
Brown lime	2	274	
Blue shale	51	325	
Blue sand	17	342	
Blue shale	60	402	
Blue sand	13	415	
Blue shale	36	451	
Blue lime	3	454	
Blue shale	8	462	
Black shale	138	600	Devonian Shales.
Blue shale	10	610	
Gray gas sand (open, 1st pay)	20	630	Corniferous.
Gray gas sand (close)	15	645	
Gray gas sand (open, 2d pay)	8	653	
Blue shale	5	658	Niagara.

No. 13—John P. Crockett farm.

Clay	3	3	
Blue sand	5	8	Waverly.
Blue shale	7	15	
Blue sand	3	18	
Blue shale	7	25	
Blue sand	10	35	
Blue shale	60	95	
Blue sand	11	106	
Blue shale	254	360	
Gray lime	2	362	
Blue shale	53	415	
Gray lime	5	420	
Black shale	159	579	Devonian Shales.
Blue shale	8	587	
Dark gas sand	16	603	Corniferous.
Light gas sand	15	618	
Light gas sand	24	642	

No. 14—James Neal farm.

	Thickness.	Depth.	Geological Formation.
Clay	9	9	
Blue sand	16	25	
Blue shale	5	30	
Blue sand	25	55	
Blue shale	45	100	
Blue sand	8	108	
Blue shale	92	200	
Blue sand	20	220	Waverly.
Blue shale	20	240	
Blue sand	48	288	
Blue shale	22	310	
Blue sand	20	330	
Blue shale	78	408	
Gray lime	12	420	
Black shale	139	559	Devonian Shales.
Blue shale	6	565	
Dark gas sand	19	584	
Light gas sand	12	596	Corniferous.
Blue gas sand	5	601	

POWELL COUNTY WELLS.

No. 1—Hardwick's Creek.

	Thickness.	Depth.	Geological Formation.
Soil	15	15	
Black shale	100	115	Devonian.
Blue shale	100	215	Niagara.
Gray lime	190	405	

No. 2—Susan Hanks farm.

Clay	4	4	
Black shale	126	130	Devonian.
Gray lime	13	143	Corniferous.
Soapstone	33	176	
Hard, gray lime	4	180	Niagara.
Soapstone	15	195	
Hard, gray lime (oil show)	3	198	
Soapstone	12	210	
Gray lime (salt water)	15	225	
Soapstone	10	235	Clinton and Hudson.
Gray lime	20	255	
Blue lime	53	308	
Gray lime	5	313	

No. 3—J. R. Ewen farm.

Clay	22	22	
Black shale	134	156	Devonian.
Gray lime	10	166	Corniferous.
Soapstone	54	220	Niagara.
Gray lime	3	223	
Soapstone	10	233	
Black lime	320	553	

No. 4—O. A. Lisle farm.

	Thickness.	Depth.	Geological Formation.
Clay	15	15	
Gray lime	2	17	Waverly.
Soapstone	15	32	
Black shale	135	167	Devonian.
Gray lime	10	177	Corniferous.
Soapstone	50	227	Niagara.
Gray lime	2	229	
Soapstone	11	240	
Blue shale	75	315	
Blue lime	522	837	

No. 5—A. M. Swango farm.

Clay	11	11	
Soapstone	10	21	Waverly.
Gray lime	3	24	
Black shale	163	187	Devonian.
Gray lime	10	197	Corniferous.
Light soapstone	43	240	Niagara.
Gray lime	3	243	Clinton.
Light soapstone	10	253	
Blue lime	997	1,250	Hudson and Upper Trenton.
Brown lime	225	1,475	Probably Birdseye and Chazy.
Light brown lime	5	1,480	
Brown lime	21	1,501	

No. 6—Maxwell Bros'. farm.

Clay	18	18	
Black shale	160	178	Devonian.
Gray lime	5	183	Corniferous.
Soapstone	107	290	Niagara.
Gray lime (oil show)	5	295	
Blue shale	30	325	
Gray lime (oil show)	10	335	
Blue lime	85	420	
Gray lime (oil show)	2	422	
Blue lime	318	740	
Gray lime	62	802	

No. 7—J. F. Martin, No. 2.

Clay	3	3	
Blue soapstone	170	173	Waverly.
Pink soapstone	8	181	
Blue soapstone	14	195	
Black shale	129	324	Devonian Shales.
Blue soapstone	30	354	
Brown lime (gas show)	20	374	Corniferous.
Blue soapstone	113	487	Niagara.
Blue lime	10	497	
Blue soapstone	23	520	
Blue lime	30	550	
Blue soapstone	15	565	
Blue lime	160	725	
Gray lime	20	745	
Blue lime	73	818	

ESTILL COUNTY WELLS.

Tom West farm—Miller's Station.

	Thickness.	Depth.	Geological Formation.
Clay	28	28	Waverly.
Blue soapstone	7	35	
Black shale	58	93	Devonian Shales.
Brown shale	51	144	
White fire-clay	2	146	
Brown sand	4	150	
Light gray stone	2	152	
White stone	86	238	
Blue soapstone	49	287	
Pink slate	46	333	
Blue shale	40	373	
Hard, gray shell	4	377	
Blue shale	8	385	
Pink slate	18	403	
Hard, brown shell	4	407	
Blue shale	8	415	
Lime shell	2	417	
Blue shale	8	425	
Blue lime	3	428	
Blue shale	2	430	
Red rock	4	434	
Blue lime	4	438	
Blue shale	5	443	
Blue lime	2	445	
Blue shale	2	447	
Blue lime	18	465	
Gray stone	18	483	
Blue shale	12	495	
Blue lime	45	540	
Blue shale	6	546	
Blue lime	59	605	

Wells on West farm, near Irvine.

	1	2	3	4	5	6
Clay	21	19	8	22	32	48
Black shale (Devonian)	43	45	63[2]	52	13	12
Estill sand (Corniferous)	30	12	15	13	16	15
	94	76	86[2]	87	61	75

MORGAN COUNTY WELL.

No. 1—Burns Well—West Liberty.

	Thickness.	Depth.	Geological Formation.
Clay	18	18	
Gray sand	68	86	
Coal	2	88	
Fire-clay	10	98	
White sand	230	328	
Black slate	40	368	Base of Conglomerate.
Blue lime	6	374	St. Louis.
White slate	40	414	
Big lime	60	474	
Black slate	14	488	Waverly.
Gray sand	532	1,020	
Black slate (Berea)	25	1,045	
White shale	50	1,095	
White sand (Berea Grit)	10	1,105	
Black shale	260	1,365	Devonian.
Blue shale	43	1,408	Niagara.
Sandy lime (1st pay)	30	1,438	Clinton.
Sand and slate	15	1,453	
Black slate	9	1,462	
Dark sand (2d pay)	40	1,502	
Hard lime	6	1,508	

This record is of doubtful accuracy in lower part.

CARTER COUNTY WELLS.

No. 1—Catherine Gregory farm.

Gravel	10	10	
Blue mud	15	25	Fire-clay.
White lime	20	45	St. Louis.
White sand	125	160	Waverly.
Blue shale	320	480	
White slate	180	660	
White sand	108	768	
White lime	60	828	
Blue slate	30	858	
Black shale	260	1,118	Devonian Shales.
White slate	12	1,130	
Black shale	40	1,170	
White slate	90	1,260	
"Ragland sand"	70	1,330	Upper Silurian and Hudson. (A few feet of the 70-foot limestone below 1,260 are probably Corniferous, and the rest Niagara and Helderburg.)
White lime	110	1,440	
White sand	10	1,450	
White lime	40	1,490	
White sand	60	1,550	
Red rock	49	1,599	

No. 2—Strait Creek Coal Co.—Near Denton.

	Thickness.	Depth.	Geological Formation.
Soil	20	20	
White, sandy shale	60	80	
White slate	20	100	
Brown sand	58	158	
Coal	2	160	
White lime and sand	110	270	
Shale and fire-clay	46	316	Coal Measures and Conglomerate.
Lime	30	346	
White slate	10	356	
White lime	9	365	
Coal	..	..	
White sand	60	425	
Black slate	10	435	
White lime	15	450	St. Louis.
White sand	60	510	
White slate	14	524	
White sand	46	570	
Limestone	109	679	Waverly.
White shale	443	1,122	
White lime	125	1,247	
White slate	28	1,275	
Brown shale	447	1,722	Devonian Shale.
Lime and fire-clay	40	1,762	
White slate	68	1,830	
White lime	80	1,910	
White slate	10	1,920	
White lime	95	2,015	

No. 3—Denton.

Soil	5	5	
Quicksand	65	70	
Blue lime	80	150	
Shale	50	200	Coal Measures and Conglomerate.
White sand	50	250	
Shale	50	300	
Sand	200	500	
St. Louis limestone	90	590	St. Louis.
Waverly	390	980	
Berea shale	90	1,070	Waverly.
Berea sand	100	1,170	
Black shale	500	1,670	Devonian Shales.
Niagara blue shale	100	1,770	
Clinton (oil)	70	1,840	Corniferous and Up per Silurian.

The 100 feet of "Niagara blue shale" of the driller probably belongs to the Devonian. His 70 feet of "Clinton" probably includes Corniferous, Niagara and Helderburg, the oil coming from the Corniferous.

No. 4—Keffer farm—Stinson Creek.

	Thickness.	Depth.	Geological Formation.
Drift	47	47	
Shale and sand	128	175	
Big Injun	125	300	
Sand	20	320	
Shale break	46	366	
Bastard lime	300	666	
Sand	200	866	
Black shale	10	876	Berea Shale.
Gordon sand (oil)	116	992	Berea Grit.
Black shale	80	1,072	
White shale	210	1,282	Devonian Shales.
Black shale	30	1,312	
Brown shale	218	1,530	
Clinton sand (oil)	33	1,566	Corniferous and Upper Silurian limestones.

(The geological divisions made by the driller are not correct.)

FLOYD COUNTY WELLS.

No. 1—T. G. Allen farm.

	Thickness.	Depth.	Geological Formation.
Soil	24	24	
Slate	92	116	
Sand	10	126	
Slate	6	132	
Sand	10	142	
Slate	35	177	
Sand	15	192	
Slate	23	215	All Coal Measures and Conglomerate.
Sand	10	225	
Slate	5	230	
Sand	46	276	
Slate	11	287	
Sand	28	315	
Slate	54	369	
Sand (black)	12	381	
Slate	129	510	
Sand (white)	15	525	
Slate (black)	5	530	Beaver Sand (?)
Sand, white (salt water)	215	745	
Coal	4	749	
Slate (black)	3	752	
Sand (gray)	21	773	
Slate	9	782	
Sand (white)	95	877	Horton Sand (?)
Slate (black)	20	897	
Sand (white)	30	927	Pike Sand (?)
Sand (black)	20	947	
Slate	98	1,045	
Sand (white)	10	1,055	
Slate (white	15	1,070	
Sand	30	1,100	
Slate	75	1,175	
Sand (oil show)	32	1,207	Salt Sand.

No. 2—Nathan Estep farm.

	Thickness.	Depth.	Geological Formation.
Conductor	35	35	
White sand	15	50	
Black slate	40	90	
Dark sand	6	96	
Black slate	86	182	All Coal Measures and Conglomerate.
Black sand	30	212	
Black slate	10	222	
Gray sand	25	247	
Black slate	85	332	
Sand	30	362	
Slate	60	422	
White sand	275	697	Beaver Sand (?)
Slate	35	732	
Sand	3	735	
Slate	10	745	
Hard sand	150	895	Horton Sand (?)
Slate	20	915	
Sand	61	976	Pike Sand (?)
Slate	86	1,062	
Hard, white sand (oil show)	55	1,117	Salt Sand (?)

No. 3—W. N. Martin farm.

Soil	38	38	
Dark sand	12	50	
Coal	4	54	
White slate	43	97	
Gray sand	13	110	
Black slate	76	186	
Dark sand	38	224	
White slate	10	234	All Coal Measures and Conglomerate.
White sand (gas)	20	254	
Dark slate	56	310	
Slate and shale	4	314	
White sand (gas)	22	336	
Black slate	76	412	
White sand (gas)	20	432	
White slate	13	445	
White sand (gas)	218	663	Beaver Sand.
Black slate	5	668	
Black sand	5	673	
Slate and shale	40	713	
White sand (salt water)	32	745	Horton Sand.
Black slate	80	825	
Black sand	5	830	
White sand	25	855	
Black slate	30	885	Pike Sand (?) (Broken).
White sand (gas)	11	896	
White slate	8	904	
White sand	16	920	
Black slate	106	1,026	
White sand (oil)	57	1,083	Salt Sand (?)

No. 4—Adam Martin farm.

	Thickness.	Depth.	Geological Formation.
Conductor	51	51	
White slate	25	76	
Black sand	69	145	
Gray sand	25	190	Coal Measures and Conglomerate 0 to 1,199.
Slate	25	215	
Dark sand	15	230	
Red rock	28	258	
Black slate	5	263	
Gray sand	193	456	Beaver and Horton together (?)
White sand (salt water)	384	840	
Black slate	10	850	
White sand	10	860	
Dark sand	10	870	
White sand	5	875	
White slate	15	890	
Sand	10	900	
Slate	30	930	
Sand	20	950	
White slate	35	985	
White sand	91	1,076	
Gray sand	111	1,187	
Black slate	12	1,199	Base of Conglomerate Series.
Lime (gas at 1,350)	211	1,410	St. Louis.
Red sand	90	1,500	Big Injun.
Gray sand	10	1,510	
Brown shale (gas)	20	1,530	
White slate	955	2,485	
Hard lime	16	2,501	

No. 5—Mud Lick of Brush Creek of Beaver Creek.

Soil	24	24	
Broken sand	51	75	
Slate and lime	69	144	
Slate	131	275	
White sand	50	325	
Slate	75	400	
White sand	80	480	
Slate	45	525	
White sand	175	700	
Slate	5	705	
White sand	30	735	
Slate	13	748	All Coal Measures and Conglomerate.
White sand	8	756	
Slate	34	790	
Lime	7	797	
Coal	2	799	
White sand	92	891	
Slate	2	893	
White sand	34	927	
Lime	10	937	
Slate	83	1,020	
Beaver sand (gas and oil)	45	1,065	
Slate	10	1,075	
Pike sand	40	1,115	

No. 6—Guffey well, near mouth of Salt Lick Creek.

	Thickness.	Depth.	Geological Formation.
Drift	45	45	
Black slate	5	50	
Coal	2	52	
Gray sand	38	90	All Coal Measures and Conglomerate.
Black slate	69	159	
Gray sand	104	263	
Light slate	41	304	
Gray sand	27	331	
Light slate	122	453	
Gray sand	30	483	
Dark slate	21	504	
White sand	174	678	Beaver Sand.
Coal and lime shell	2	680	
Slate	34	714	
White sand	22	736	Horton Sand.
Sandy slate	15	751	
White sand	79	830	
Coal	1	831	
Gray sand	18	849	
Black slate	3	852	
Black sand	29	881	
Black slate	80	961	
White sand (gas)	39	1,000	Pike Sand.

No. 7—Cow Creek—One mile above mouth.

Drift	40	40	All Coal Measures and Conglomerate.
Sand and slate	160	200	
Slate, some sand	300	500	
White sand (salt water)	245	745	Beaver Sand.
Coal	5	750	
Slate	110	860	
White sand (gas)	25	885	Horton Sand.
Slate and sand shells	20	905	
Slate	10	915	
White sand (salt water)	27	942	Pike Sand.

No. 8—Osborn well—Right Beaver, one and one-half miles below Brush Creek.

Drift	19	19	
Sand and slate	256	275	
White sand	30	305	
Slate	130	435	All Coal Measures and Conglomerate.
Sand	293	728	
Shelly slate	152	880	
Sand—Gas at 882.			
Sand—Oil at 896 to 901.			
Sand—Oil at 911.			

No. 9—Geo. Allen farm—Granny Hale branch of Right Beaver.

	Thickness.	Depth.	Geological Formation.
Drift	18	18	
Gray sand	42	60	
Coal	2[2]	62	
Gray sand	80	142	All Coal Measures and Conglomerate.
Black slate	81	223	
Coal	3[2]	226	
Gray sand	31	257	
Black slate	81	338	
Sandy slate	69	407	
Gray sand	30	437	
Black slate	14	451	
Gray sand	36	487	
Coal	10	497	
Gray sand	6	503	
Dark slate	39	542	
Gray sand	50	592	
Dark slate	41	633	
Gray sand	14	647	
Slate	170	817	
Gray sand (gas)	63	880	Beaver and Horton together (?).
White sand (salt water)	239	1,119	
Gray sand	65	1,184	
Slate	6	1,190	
Gray sand	12	1,202	
Dark slate	60	1,262	
Light sand (gas and oil)	39	1,301	Pike Sand (?).
Dark slate	5	1,306	
White sand (oil show)	68	1,374	
Black slate	40	1,414	
White sand (gas)	28	1,442	Salt Sand (?).

No. 10—James Prater farm—Head of Prater Fork of Brush Creek.

Drift	11	11	
Slate	26	37	
Sand	6	43	
Slate	49	92	All Coal Measures and Conglomerate.
Sand	6	98	
Slate	33	131	
Sand	41	172	
Slate	34	206	
Sand	20	226	
Slate	54	280	
Sand	71	351	
Slate	30	381	
Sand	10	391	
Slate	60	451	
Sand	7	458	
Slate	12	470	
Sand	11	481	
Slate	40	521	
Sand	4	525	
Slate	11	536	
Sand	17	553	
Slate	15	568	
White sand	178	746	Beaver (?).

	Thickness.	Depth.	Geological Formation.
Coal	1	747	
Sand	27	774	
Coal	3[2]	777	
Sand	17	794	
Slate	12	806	
Coal	2[2]	808	
Gray sand	13	821	Horton (?).
White sand	53	874	
Coal	2[2]	876	
Very dark sand	7	883	
Very dark slate	3	886	
Very dark sand	6	892	
Black slate	22	914	
Yellow slate	6	920	
White sand (gas)	37	957	Pike (?).

No. 11—Head of Prater Fork of Brush Creek.

Drift	46	46	
Light slate	35	81	
Gray sand	10	91	
Light slate	42	133	All Coal Measures and Conglomerate.
Gray sand	30	163	
Light slate	8	171	
Gray sand	62	233	
Light slate	30	263	
Gray sand	14	277	
Light slate	76	353	
Gray sand	20	373	
Dark slate	34	407	
Gray sand	9	416	
Light slate	27	443	
Gray sand	55	498	
Light slate	99	597	
Gray sand	6	603	
Slate	4	607	
White sand	145	752	Beaver and Horton Sands.
Coal	1	753	
Light gray sand	65	818	
Coal	1	819	
Light gray sand	109	928	
Slate	2	930	
Very dark sand	10	940	
Black slate	6	946	
Gray and white sands (gas, oil and salt water)	150	1,096	Pike Sand.
Black slate	35	1,131	
Sand	5	1,136	Salt Sand.

No. 12—Esther Horton farm—Rock Creek, one and three-quarter miles above mouth.

	Thickness.	Depth.	Geological Formation.
Drift	20	20	
Slate	24	44	
Sand	19	63	
Slate	57	120	All Coal Measures and Conglomerate.
Sand	20	140	
Slate	55	195	
Sand	12	207	
Slate	23	230	
Sand	20	250	
Shelly slate	200	450	
White sand (gas)	145	595	Beaver Sand.
Slate	2	597	
White sand	83	680	Horton Sand.
Gray sand	5	685	
Black sand	4	689	
Coal	1[2]	690	
Black slate	28	718	
Coal	2[2]	720	
Black slate	6	726	
White sand (gas)	10	736	Pike Sand.
Dark sand	23	759	
White sand	69	828	
Black sand	7	835	
Black slate	12	847	
Gray sand (gas and oil show)	11	858	
Black slate	6	864	
White sand (oil)	23	887	Salt Sand.

No. 13—Green Pitts farm—Head of Pitts' Fork of Middle Creek.

Drift	22	22	
Slate	80	102	
Sand	30	132	
Black slate	37	169	All Coal Measures and Conglomerate.
Sand	38	207	
Slate	5	212	
Sand	37	249	
Shelly slate	48	297	
Sand	26	323	
Slate	77	400	
White sand	64	464	
Slate	189	653	
White sand	118	771	Beaver Sand.
Slate	3	774	
White sand (gas and salt water)	221	995	Horton Sand.
Vehy dark sand	5	1,000	
White sand	156	1,156	Pike Sand.
Dark gray sand (gas)	10	1,166	
Slate	18	1,184	
White sand	46	1,230	Salt Sand.

No. 14—David Hays farm—Right Beaver.

	Thickness.	Depth.	Geological Formation.
Drift	31	31	
Sand	15	46	
Slate	22	68	
Sand	12	80	
Slate	75	155	All Coal Measures and Conglomerate.
Sand	36	191	
Slate	9	200	
Sand	30	230	
Slate	206	436	
Sand	154	590	Beaver Sand.
Slate	5	595	
Sand	85	680	
Slate	4	684	
Sand (salt water)	301	985	
Slate	5	990	
Shelly sand	50	1,040	
Slate	64	1,104	
White sand	15	1,119	
Gray sand (oil show and salt water) *	29	1,148	
Slate	3	1,151	
Gray sand (salt water)	26	1,177	Salt Sand.

No. 15—Jos. Gearhart farm—Salt Lick Creek, one and one-quarter miles up.

Conductor	27	27	
Gray sand	37	64	
Coal	1	65	
Black slate	15	80	
White sand	70	150	
Black slate	50	200	
Gray sand	50	250	
Dark lime	10	260	
Gray sand (gas)	50	310	
Slate (gas)	163	473	
Gray sand	47	520	
Light slate	38	558	Coal Measures and Conglomerate.
White sand	156	714	
Sandy lime	5	719	
Gray sand	126	845	
Black shale	1	846	
Dark lime	5	851	
Sand	54	905	
Shelly slate	5	910	
Sand (gas)	18	928	
Very black slate	52	980	
Sand (gas, oil and salt water)	178	1,158	
Black lime	5	1,163	Base of Conglomerate.
Blue slate	2	1,165	
Red shale	5	1,170	Mauch Chunk.
Dark lime	2	1,172	

No. 16—Susanna Gearhart farm—Right Beaver, below mouth of Salt Lick.

	Thickness.	Depth.	Geological Formation.
Conductor	38	38	
Black slate	3	41	
Gray sand	15	56	
Limy slate	19	75	
Gray lime	8	83	All Coal Measures and Conglomerate, except last member.
Black slate	22	105	
Gray sand	15	120	
Lime	10	130	
Black slate	45	175	
Gray sand	100	275	
Slate	194	469	
Sand (oil, gas and salt water)	123	592	Beaver Sand.
Black slate	12	604	
White sand	191	795	Horton Sand.
Coal	1	796	
Gray lime	12	808	
Gray sand	40	848	
Black slate	55	903	
White sand (gas)	90	993	Pike Sand.
Slate and sand shells	20	1,013	
Reddish sand	40	1,053	
Dark slate	2	1,055	
White sand (salt water)	45	1,100	Salt Sand.
Lime	2½	1,102[2]	Top of Mauch Chunk.

No. 17—Geo. Allen farm—Right Beaver, five-eighths of a mile above Salt Lick.

Conductor	46	46	
Black slate	14	60	
Gray sand	18	78	
Slate and sand shells	90	168	All Coal Measures and Conglomerate.
Coal	2	170	
Gray sand (gas)	97	267	
Slate and sand shells	126	393	
Sand (gas and salt water)	412	805	Beaver and Horton together (?).
Coal or bituminous shale	1	806	
Slaty lime	4	810	
Dark sand	17	827	
Very black slate (gas)	47	874	
Sand (gas, oil and salt water)	120	994	Pike Sand.
Black slate	6	1,000	

No. 18—Mouth of Salt Lick.

Conductor	50	50	
Slate and coal	5	55	All Coal Measures and Conglomerate.
Gray sand	40	95	
Black slate	60	155	
Gray sand	41	196	
Light slate	61	257	
Dark sand	11	268	
Light slate	156	424	
Gray sand	61	485	
Dark slate	15	500	
White sand (gas and salt water)	156	656	Beaver Sand.

	Thickness.	Depth.	Geological Formation.
Very black slate	2	658	
Light sand	5	663	
Black slate	22	685	
Light sand	102	787	Horton Sand.
Coal	1	788	
Dark, slaty sand	61	849	
Black slate	62	911	
White sand (oil)	54	965	Pike Sand.

No. 19—John Martin farm—East of mouth of Salt Lick.

Conductor	22[2]	22[2]	
Gray sand	17[2]	40	All Coal Measures and Conglomerate.
Light slate	60	100	
Black slate	6	106	
Light slate	94	200	
Gray sand	30	230	
Slate	238	468	
Gray sand	65	533	
Black slate	8	541	
Dark sand	10	551	Beaver Sand.
Light sand	112	663	Beaver Sand.
Dark slate	5	668	
Gray sand	13	681	
Dark slate	49	730	
Light sand	100	830	Horton Sand.
Gray sand	20	850	Horton Sand.
Dark slate	7	857	
Gray sand	20	877	
Dark slate	30	907	
White sand	20	927	
Dark slate and shells	24	951	
Gray and white sands (oil)	16	967	Pike Sand.
Black, sandy slate	9	976	
Light sand	9	985	
Shelly slate	15	1,000	
Black slate and red shale	13	1,013	
Gray sand (gas)	12	1,025	
Black slate	40	1,065	
Gray sand (gas)	18	1,083	
Black slate	8	1,091	
Gray, white and pebbly sands (gas and salt water)	51	1,142	Salt Sand.

No. 20—John Martin, No. 3.

Soil	21	21	
Sand	19	40	All Coal Measures and Conglomerate Measures.
Coal	3	43	
White slate	57	100	
Coal	5	105	
Sand	30	135	
Slate	60	195	
Sand	15	210	
Slate	95	305	
White sand	85	390	
Slate	204	594	

	Thickness.	Depth.	Geological Formation.
Sand	246	840	Beaver Sand.
Black shale	10	850	
Sand	190	1,040	Horton Sand.
Slate	15	1,055	
Sand	60	1,115	Pike Sand.
Slate	20	1,135	
Shale	80	1,215	
Sand	52	1,267	Salt Sand.

Oil show at 1,216. Salt water at 1,265.

No. 21—Jas. Prater farm—Head of Prater Fork of Brush Creek.

Drift	46	46	
Gray sand	20	66	All Coal Measures and Conglomerate.
Light slate	46	112	
Gray sand	41	153	
Light slate	87	240	
Gray sand	30	270	
Coal	1[2]	271	
Light slate	299	570	
Light gray sand (gas)	190	760	Beaver Sand.
Slate	4	764	
Sand	61	825	Horton Sand.
Coal	3[2]	828	
Sand	30	858	
Coal	2[2]	860	
Sand	26	886	
Coal	1[2]	887	
Slate	6	893	
Sandy slate	22	915	
Yellow slate	6	921	
Red shale	10	931	
Gray sand / White sand — Gas, oil and salt water.	228	1,159	Pike Sand thickened, or else Pike and Salt Sands run together.

No. 22—Mary Estep farm—Right Beaver.

Drift	37	37	All Coal Measures and Conglomerate.
Slate	123	160	
Sand	102	262	
Dark slate	173	435	
Gray sand	10	445	Beaver Sand.
White sand	236	681	Beaver Sand.
Coal	2[2]	683	
Gray sand	8	691	
Slate	25	716	
White sand	149	865	Horton Sand.
Dark gray sand	10	875	Horton Sand.
Dark slate	45	920	
White sand (oil)	44	964	Pike with a break in it.
Slate and shells	19	983	Pike with a break in it.
White sand (gas)	43	1,026	Pike with a break in it.
Dark slate	18	1.044	
White sand (oil)	26	1,070	Salt Sand.

The Coal Measures probably extend down to 160.

The sands number five instead of four, the Pike Sand being probably split by a bed of slate.

No. 23—T. G. Allen, No. 6.

	Thickness.	Depth.	Geological Formation
Soil	42	42	
Slate	7	49	Coal Measures and
Sand	50	99	Conglomerate to 1,180.
Slate	83	182	
Sand	68	250	
Slate	90	340	
Sand	20	360	
Slate	100	460	
Sand	178	638	
Slate	5	643	
Sand	183	826	Beaver Sand.
Coal	2	828	
White sand	20	848	
Slate	5	853	
Black sand	25	878	
White sand	30	908	Horton Sand.
Slate	46	954	
White sand	12	966	
Black sand	10	976	
White sand (salt water)	10	986	
Black sand	15	1,001	Pike Sand.
White sand	5	1,006	
Black sand	10	1,016	
White sand	20	1,036	
Slate	5	1,041	
Sand	10	1,051	
White slate	25	1,076	
White shale	15	1,091	
Sand (oil show at 1,092)	19	1,110	
Slate	6	1,116	Salt Sand.
Sand	32	1,148	
Slate	32	1,180	
Lime	210	1,390	St. Louis.
Slate	50	1,440	
Red sand	47	1,487	Big Injun.

No. 24—W. M. Martin, No. 2.

Soil	40	40	
Black slate	40	80	
Gray sand	40	120	
Coal	5	125	All Coal Measures and
Sand	20	145	Conglomerate.
Black slate	40	185	
Red sand	40	225	
Gray sand	95	320	
Black slate	55	375	
Dark sand	20	395	
White slate	70	465	
White sand	20	485	
Black slate	15	500	
Salt sand	212	712	Beaver Sand.
Black slate	33	745	
Salt sand (salt water at 765)	116	861	Horton Sand.
Black slate	7	868	
Dark sand	37	905	

	Thickness.	Depth.	Geological Formation.
Black slate	5	910	
Gray sand	35	945	
White slate	10	955	
White sand	19	974	Pike (broken).
Black slate	51	1,025	
Gray sand	60	1,085	
Black slate	15	1,100	
White sand	71	1,171	Salt Sand.

No. 25—John Burchett farm—Cow Creek, three miles above mouth.

Conductor	22	22	All Coal Measures and
Slate	48	70	Conglomerate.
Coal	3[2]	73	
Slate	77	150	
Sand	30	180	
Slate	45	225	
Sand	30	255	
Slate	50	305	
Sand	5	310	
Slate	115	425	
Sand	40	465	
Slate	78	543	
White and gray sands	287	830	Beaver Sand.
Slate, very black at base	27	857	
Gray and white sands	61	918	Horton Sand.
Shelly slate	20	938	
Slate	42	980	
White sand	23	1,003	Pike Sand.

No. 26—G. T. Kendrick farm—Head of Cow Creek.

Conductor	33	33	
Black slate	30	63	
Gray sand	9	72	
Dark slate	75	147	
Gray sand	32	179	
Dark slate	60	239	
Gray sand	42	281	
Dark slate	19	300	
Gray sand	20	320	
Dark slate	20	340	
Gray sand	37	377	
Dark slate	20	397	
Gray sand	30	427	
Dark slate	20	447	
Gray sand	32	479	
Dark slate	171	650	
Coal	2[2]	652	
Sand	10	662	
Black slate	5	667	
Gray and white sands	53	720	Beaver Sand.
Black slate	12	732	
White sand	108	840	Horton Sand (broken).
Coal	1	841	
White sand	55	896	
Dark gray sand	10	906	
Black slate	10	916	

	Thickness.	Depth.	Geological Formation.
Gray and white sands	107	1,023	Pike Sand.
Dark slate	40	1,063	
Gray and white sands	65	1,128	Salt Sand.
Dark slate	5	1,133	
Dark gray sand	10	1,143	Base of Conglomerate.
Slate and red shale	120	1,263	Mauch Chunk (?).
Gray sand	8	1,271	
Limy slate	62	1,333	
Sand and lime	40	1,373	
Dark slate	10	1,383	
Sand and slate	10	1,393	
Dark slate	17	1,410	

No. 27—Jack Allen farm—Salt Lick Creek, near mouth.

Drift	43	43	
Black slate	48	91	
Gray sand	27	118	
Light slate	53	171	All Coal Measures and Conglomerate.
Light sand	47	218	
Dark slate	5	223	
Dark sand	35	258	
Dark slate	60	318	
Gray sand	23	341	
Light slate	40	381	
Light sand	15	396	
Dark slate	42	438	
White sand (pebbles, gas and salt water)	232	670	Beaver Sand.
Dark slate	24	694	
White sand	145	839	Horton Sand.
Black sand	20	859	
Shelly slate	20	879	
Black slate	50	929	
White sand (gas)	77	1,006	Pike Sand.
Slate	8	1,014	

No. 28—Jos. Gray farm—Left Fork of Bull Creek, four miles up.

Drift	8	8	
Gray sand	37	45	
Light slate	95	140	
Gray sand	38	178	All Coal Measures and Conglomerate.
Shelly slate	77	255	
Gray sand	105	360	
Dark slate	91	451	
Gray sand	20	471	
Dark slate	30	501	
White sand (gas and salt water)	194	695	Beaver Sand.
Dark slate	13	708	
Coal	2[2]	710	
White sand	74	784	Horton Sand.
Coal	1	785	
Gray sand	35	820	
White sand	6	826	Pike Sand.
Gray sand	2	828	
White sand (salt water)	72	900	
Deep-red shale	35	935	
Gray sand	7	942	
Red shale	20	962	
White sand (salt water)	68	1,030	Salt Sand.

No. 29—Allen Transfer well—Mouth of Pitts' Fork.

	Thickness.	Depth.	Geological Formation.
Drift	32	32	
Light slate	5	37	
Very dark sand	8	45	
Very dark slate	5	50	All Coal Measures and Conglomerate.
Coal	2[2]	52	
Dark slate	20	72	
Gray sand	55	127	
Dark slate	30	157	
Gray sand	20	177	
Dark slate	65	242	
Gray sand	50	292	
Black slate	5	297	
Gray sand	20	317	
Black slate	63	380	
Gray sand	15	395	
Black slate	95	490	
White sand (oil and salt water)	262	752	Beaver Sand.
Gray sand	20	772	
Dark slate	2	774	
White sand	30	804	Horton Sand.
Coal	3[2]	807	
Gray sand	11	818	
Dark slate	22	840	
White sand (gas, oil and salt water)	233	1,073	Pike and Salt Sands.
Black slate	15	1,088	

No. 30—A. S. Crisp farm—Buck's Branch, one and one-third miles up.

Drift	15	15	
Gray sand	12	27	
Light slate	25	52	
Coal	3[2]	55	
Gray sand	8	63	
Light slate	18	81	All Coal Measures and Conglomerate.
Gray sand	14	95	
Light slate	20	115	
Gray sand	12	127	
Slate	20	147	
Coal	4[2]	151	
Gray sand	24	175	
Black slate	75	250	
Gray sand	58	308	
Black slate	42	350	
White sand	18	368	
Black slate	38	406	
Gray sand	22	428	
Black slate	30	458	
Dark gray sand	12	470	
Black slate	37	507	
Gray sand (salt water)	129	636	Beaver Sand.
Black slate	6	642	
White sand (salt water)	30	672	Horton Sand (broken).
Light slate	12	684	
White sand (salt water)	41	725	
Black slate	28	753	
White sand (salt water)	47	800	

	Thickness.	Depth.	Geological Formation.
Black slate	5	805	
Gray sand	20	825	
Black slate	16	841	
Yellow slate, lime and grit	26	867	
Gray sand (gas and salt water)	38	905	Pike Sand.
Very red shale	18	923	
Blue slate	7	930	
Very red shale	40	970	
Black slate	40	1,010	
Gray sand	12	1,022	
Light slate	19	1,041	
Dark gray sand	4	1,045	
White sand (salt water)	5	1,050	Salt Sand.
Gray sand (oil)	11	1,061	

No. 31—James Hicks farm—Head of Brush Creek.

Drift	18	18	
Slate	21	39	
Gray sand	2	41	
Slate	15	56	All Coal Measures and Conglomerate.
Gray sand	18	74	
Slate	26	100	
Gray sand	10	110	
Slate	25	135	
Gray sand	112	247	
Slate	153	400	
Gray sand	12	412	
Slate	38	450	
Gray sand	25	475	
Sandy slate	73	548	
Gray sand	27	575	Beaver and Horton Sands (broken).
White sand (gas)	55	630	
Dark slate	5	635	
White sand (gas)	54	689	
Dark slate	3	692	
White sand (salt water)	127	819	
Coal and slate	2	821	
White sand	83	904	
Coal	1	905	
Gray sand	7	912	
Dark slate	38	950	
White sand (gas)	69	1,019	Pike Sand.
Dark slate	30	1,049	
Gray and white sands (oil and salt water)	115	1,164	Salt Sand.

No. 32—Marion Rice farm—Prater Fork, three and one- half miles up.

Drift	23	23	
Light slate	18	41	
Dark slate	20	61	
Black slate	25	86	
Dark slate	22	108	
Coal	4[2]	112	
Dark slate	70	182	
Gray sand	4	186	
Slate	19	205	

	Thickness.	Depth.	Geological Formation.
Dark sand	5	210	
Black slate	26	236	
Light slate	8	244	
Dark gray sand	43	287	
Dark slate	43	330	
Gray sand	58	388	
Black slate	68	456	
Gray sand	115	571	Beaver Sand.
Black slate	18	589	
Gray sand	12	601	Horton Sand.
White sand (salt water)	34	635	
Gray sand	97	732	
White sand	41	773	
Black slate	14	787	
Brown, sandy slate	4	791	
White sand	48	839	Pike Sand.
Gray sand	28	867	
Black slate	7	874	
Gray sand	40	914	
Black slate	78	992	
Gray sand	28	1,020	Base of Conglomerate.
Lime	6	1,026	Mauch Chunk.
Red shale	17	1,043	

No. 33—Jack Allen farm—Mott's Branch of Salt Lick.

Drift	22	22	
Gray sand	38	60	
Slate	15	75	
Gray sand	39	114	
Slate	71	185	
Gray sand	51	236	
Slate	15	251	
Gray sand	20	271	
Slate	69	340	
Gray sand	15	355	
Slate	105	460	
Gray and white sands (gas)	269	729	Beaver Sand.
Coal	1[2]	730	
Dark slate	14	744	
White sand	96	840	Horton Sand.
Coal	1[2]	841	
Gray sand	29	870	Pike Sand (broken).
Dark slate	6	876	
White sand	10	886	
Dark slate	97	993	
Gray and white sands (gas and salt water)	133	1,126	Salt Sand.
Lime	9	1,135	Mauch Chunk.

No. 34—Geo. Allen farm—Right Beaver, one-third mile above Salt Lick.

	Thickness.	Depth.	Geological Formation.
Drift	30	30	
Slate	12	42	
Coal	4[2]	46	
Slate	18	64	All Coal Measures and Conglomerate.
Gray sand	16	80	
Slate	23	103	
Gray sand	25	128	
Dark slate	25	153	
Light sand	22	175	
Dark slate	6	181	
Coal	3[2]	184	
Dark slate	73	257	
Light sand	36	293	
Slate	203	496	
Gray sand	194	690	Beaver Sand.
White sand	25	715	
Gray sand	27	742	
Light slate	6	748	
White sand	165	913	Horton Sand.
Coal	1[2]	914	
Dark slate	5	919	
Gray sand	8	927	
Dark slate	58	985	
White and gray sands (gas and oil)	29	1,014	Pike Sand.
Dark slate	4	1,018	
Gray sand	13	1,031	
Dark slate	4	1,035	
Gray sand	10	1,045	
Slate and red rock	8	1,053	
Gray and white sands (gas and salt water)	31	1,084	Salt Sand (broken).
Black slate	45	1,129	
Gray and white sands	50	1,179	

No. 35—R. S. Elliott farm—Head of Big Mud Creek.

Drift	31	31	
Slate	50	81	
Blue sand	76	157	
Dark slate	81	238	All Coal Measures and Conglomerate.
Gray sand	64	302	
Dark slate	98	400	
Dark sand	15	415	
Dark slate	12	427	
Gray sand	23	450	
Dark slate	186	636	
White sand	28	664	
Slate	20	684	
White sand	291	975	Beaver Sand.
Dark slate	75	1,050	
White sand	50	1,100	Horton Sand.
Dark slate	23	1,123	
White sand (oil and salt water)	352	1,475	Pike Sand.
Gray sand	83	1,558	
Slate	8	1,566	

	Thickness.	Depth.	Geological Formation.
Red shale	24	1,590	
Gray sand	28	1,618	
White sand (oil show)	3	1,621	Salt Sand.
Gray sand	89	1,710	
White sand	21	1,731	
Black slate	30	1,761	

No. 36—Jack Allen farm—Mouth of Salt Lick.

Drift	38	38	
Coal	2	40	
Gray sand	50	90	
Slate	75	165	All Coal Measures and Conglomerate.
Gray sand	50	215	
Slate	15	230	
Gray sand	18	248	
Black slate	32	280	
Gray sand	30	310	
Dark slate	120	430	
Gray sand (gas)	60	490	Beaver Sand (broken).
Black slate	8	498	
Gray sand	32	530	
White sand	45	575	
Gray sand	93	668	
Coal	1	669	
Slate	34	703	
White sand	98	801	Horton Sand.
Coal	1	802	
Gray sand	4	806	
Black slate	15	821	
Gray sand	29	850	
Dark slate	69	919	
Gray sand	41	960	Pike Sand (broken).
Slate	19	979	
Gray sand	19	998	
Slate	2	1,000	

No. 39—Dan Howard farm.

Drift	12	12	
Black slate	185	197	
Coal	3[2]	200	
Gray sand	27	227	All Coal Measures and Conglomerate.
Slate	93	320	
Coal	3[2]	323	
Slate	97	420	
Gray sand	44[2]	464	
Black slate	85	549	
Gray sand	31	580	
Slate	72	652	
White sand (gas and salt water)	416	1,068	Beaver and Horton Sands.
Very black slate	3	1,071	
Gray sand	13	1,084	
Dark slate	60	1,144	
Gray sand	7	1,151	Pike Sand.
Gray and white sands (oil)	61	1,212	

PIKE COUNTY WELLS.

No. 1—Well on Poor Farm, two miles from Pikeville.

	Thickness.	Depth.	Geological Formation.
Conductor	52	52	
Gray sand	8	60	Coal Measures and
Slate	75	135	Conglomerate to 1,307.
Gray sand	29	164	
Slate	76	240	
Gray sand	40	280	
Slate	154	434	
Gray sand	24	458	
Slate	60	518	
White sand	289	807	Beaver Sand (?).
Black slate	56	863	
White sand	52	915	Horton Sand (?)
Black slate	5	920	
Gray sand	15	935	Pike Sand (?).
White sand	132	1,067	
Black slate	7	1,074	
Gray sand	61	1,135	
Slate	5	1,140	
Gray sand	12	1,152	
Shelly slate	35	1,187	
Gray sand	11	1,198	
White sand	8	1,206	
Gray sand	28	1,234	
Light slate	25	1,259	
Light sand	20	1,279	
Sandy slate	12	1,291	
Gray sand	16	1,307	Base of Conglomerate Series (?).
Gray lime	12	1,319	Mauch Chunk.
Dark slate	3	1,322	
Red rock	88	1,410	
White sand	7	1,417	
Black slate	15	1,432	
Dark lime	4	1,436	
Very black slate	70	1,506	(St. Louis missing).
White sand (gas)	36	1,542	Big Injun Group.
Red slate	21	1,563	
White sand (salt water)	27	1,590	

No. 2—Bowles farm—Hurricane Creek, five miles from Pikeville.

Drift	18	18	
Gray sand	27	45	
Dark slate	50	95	
Gray sand	15	110	
Dark slate	48	158	Coal Measures and
Gray sand	46	204	Conglomerate to 1,314
Dark slate	81	285	
Gray sand	45	330	
Light slate	53	383	
Black slate	25	408	
Gray sand	40	448	

	Thickness.	Depth.	Geological Formation.
Dark slate	132	580	
Gray sand	40	620	
Dark slate	50	670	
Gray sand	36	706	
White sand	72	778	
Dark sand (salt water)	18	796	
Light sand	134	930	
Dark slate	52	982	(Three Sands in Conglomerate at 670, 982
White sand (gas)	59	1,041	and 1,053.)
Dark slate	12	1,053	
Gray sand (salt water)	171	1,224	
White sand	16	1,240	
Black slate	30	1,270	
Gray sand	32	1,302	
Black slate	12	1,314	Base of Conglomerate Measures.
Limy sand	18	1,332	Chester Group (Mauch Chunk).
Light slate	17	1,349	
White sand	13	1,362	
Lime	16	1,378	
Slate	5	1,383	
Red shale	3	1,386	
Red, sandy shale	14	1,400	
Red shale and slate	32	1,432	
Dark gray sand	4	1,436	
Limy sand	36	1,472	May be St. Louis partly cut out.
Sand (gas and salt water)	182	1,654	Big Injun.
Black slate	108	1,762	Pocono Slate.
Lime	2	1,764	

No. 3—Cedar Creek.

Soil	41	41	
Light slate	23	64	
Gray sand	10	74	
Dark slate	40	114	(Two Sands in Conglomerate—one at 50(
Gray sand	10	124	and one at 857.)
Whitish slate	96	220	
Coal	4²	224	
Dark slate	176	400	
Gray sand	25	425	
Black slate	75	500	
White sand	285	785	
Dark slate	72	857	
White sand	218	1,075	
Black sand	10	1,085	
White sand	10	1,095	
Gray sand	72	1,167	
Shelly slate	108	1,275	Base of Conglomerate Measures in this.
Red shale	105	1,380	Chester Group (Mauch Chunk).
White sand	40	1,420	
Black slate	5	1,425	(Mountain Lime missing.)
Gray and white sands (salt water)	74	1,499	Big Injun.

No. 4—Henry Taylor farm—Brushy Fork of John's Creek.

	Thickness.	Depth.	Geological Formation.
Drift	13	13	
Gray sand	42	55	Coal Measures and
Slate	160	215	Conglomerate to 1,201
Gray sand	70	285	
Black slate	50	335	
Coal	5[2]	340	
Light slate	7	347	
Gray sand	38	385	
Dark slate	113	498	
White sand	48	546	Beaver Sand.
Gray sand	21	567	
Dark slate	65	632	
Gray sand	33	665	
Black slate	35	700	
Gray sand	12	712	
Sandy slate	26	738	
Gray sand (gas)	50	788	Horton Sand.
Dark sand (salt water)	22	810	
Slate	11	821	
White sand	99	920	Pike Sand.
Dark slate	5	925	
White sand (salt water)	47	972	
Dark slate	5	977	
White sand (salt water)	41	1,018	Salt Sand.
Sandy slate	54	1,072	
White pebbly sand (gas and salt water)	129	1,201	
Lime	15	1,216	Base of Conglomerate Measures.
Black slate	18	1,234	
Red shale	22	1,256	Chester Group (Mauch Chunk).
Blue slate	34	1,290	
Lime	15	1,305	(St. Louis missing.)
Blue and white sand (salt water)	83	1,388	Big Injun.
Slate	2	1,390	Top of Pocono Slate.

KNOX COUNTY WELLS.

No. 1—Payne's Creek, eleven miles northwest of Barbourville.

Soil	6	6	
Quicksand	6	12	
Sand	8	20	
Black shale	35	55	
Coal	3	58	
Slate and shale	25	83	
Sand	5	88	Coal Measures and
Shale	20	108	Conglomerate.
Sand	12	120	
Shale and slate	64	184	
Black shale	18	202	
Sand	30	232	
Shale	150	382	
Sand	40	422	
Sand and slate	52	474	

No. 2—Payne's Creek.

	Thickness.	Depth.	Geological Formation.
Soil	12	12	
Quicksand	4	16	
Soapstone	4	20	
Sand	40	60	
Slate	115	175	
Sand	10	185	
Shale	127	312	Coal Measures and Conglomerate.
Sand	10	322	
Slate	18	340	
Sand	10	350	
Shale	60	410	
Sand	80	490	
Slate	20	510	
Sand	60	570	
Shale	38	608	
Sand	222	830	
Shale	35	865	
Sand and shale	50	915	
Coal	3	918	
Sand	32	950	
Shale	4	954	
Sand	49[2]	1,003[2]	

No. 3—Caleb Powers farm, near Whitley line.

Soil	10	10	
Sand	15	25	
Shale	325	350	
Sand	45	395	Coal Measures and Conglomerate.
Slate	50	445	
Sand	200	645	
Slate	5	650	
Sand	100	750	
Coal	4	754	
Slate	5	759	
Sand	151	910	

No. 4—Barbourville.

Soil	23	23	
Sand	27	50	
Shale	45	95	
Slate	65	160	Coal Measures and Conglomerate.
Slate and shale	40	200	
Hard, sandy lime	5	205	
Slate and sand shells	110	315	
Gray lime	8	323	
Slate	27	350	
Sand	68	418	
Slate	2	420	
Sand (oil at 430)	45	465	Jones Sand (?).

No 5—Thos. Henson farm—Fighting Creek, two and one-half miles from Barbourville.

	Thickness.	Depth.	Geological Formation.
Soil and black slate	50	50	
Close, hard sand	60	110	All Coal Measures and Conglomerate.
Loose shale	50	160	
Water sand	100	260	
Shale and slate	12	272	
"Wages" sand	48	320	Wages Sand.
Very close sand (show of oil and gas)	70	390	
Loose pebbles, shale, etc	10	400	
"Jones" sand	90	490	Jones Sand.
Black sand	2	492	

No. 6—Thomas Poindexter farm—Fighting Creek, one-quarter mile northeast of No. 5.

Soil	20	20	
Gravel	10	30	
Blue clay	20	50	
Coal	3	53	All Coal Measures and Conglomerate.
Clay and shale	7	60	
White sand	40	100	
Black slate	20	120	
Shale, slate and shells	72	192	
Gray sand	12	204	
Loose shale	25	229	
White sand	10	239	
Shale, slate and shells	30	269	
Loose, gray sand	4	273	
White sand	90	363	Wages Sand (?).
Shell and slate	70	433	
White sand	12	445	
Black slate	10	455	
Coal	4	459	
Shale	16	475	
Gray sand	16	491	
White sand	4	495	
Black sand	10	505	Jones Sand (?).
White sand	9	514	

No. 7—James Brindstaff farm—Fighting Creek (adjoins No. 6).

Soil	10	10	
Gray sand	45	55	
Blue slate (water)	6	61	
White sand (water)	12	73	All Coal Measures and Conglomerate.
Slate and shell	17	90	
Blue clay	20	110	
Slate and shell	82	192	
Black sand	10	202	
Slate and shells	16	218	
White sand (oil show)	57	275	Wages Sand (?).
Slate, shale and shells	60	335	
White sand	65	400	
Blue sand	10	410	
White sand (oil at 448 and 471)	91	501	Jones Sand (?).

No. 8—James Brindstaff, No. 2.

	Thickness.	Depth.	Geological Formation.
Surface and sand	10	10	
Sand	30	40	
Blue sand	10	50	
Gray sand	15	65	All Coal Measures and Conglomerate.
Brown slate	35	100	
Brown shale	65	165	
White sand	8	173	
Brown shale	22	195	
Slate and shells	7	202	
Slate and shells	16	218	
White sand	57	275	Wages Sand (?).
Slate, shale and shells	60	335	
White sand	65	400	
Blue sand	10	410	
White sand (oil at 448 and 471)	91	501	Jones Sand (?).

No. 9—James Brindstaff, No. 3.

Clay	10	10	
Blue sand	40	50	
Gray sand	15	65	All Coal Measures and Conglomerate.
Brown slate	35	100	
Brown shale	65	165	
White sand	8	173	
Brown shale	22	195	
White sand	86	281	Wages Sand (?).
Brown shale	49	330	
White sand	12	342	
White slate	20	362	
White sand	10	372	
Brown shale	20	392	
White sand	88	480	Jones Sand (?).

No. 10—Mollie Maniss farm—Fighting Creek, east of No. 9.

Clay	10	10	
Shale	15	25	
Coal	1	26	
Shale	34	60	All Coal Measures and Conglomerate.
Sand	30	90	
Slate	13	103	
Coal	7	110	
Shale	80	190	
Sand	55	245	
Shale	4	249	
Sand	106	355	
Shale (oil)	35	390	

No. 11—James Goodin farm—Fighting Creek, east of No. 10.

	Thickness.	Depth.	Geological Formation.
Quicksand	15	15	
Lime	45	60	
Slate	35	95	
Black slate	50	145	
Lime	25	170	All Coal Measures and Conglomerate.
White slate	25	195	
Black slate	20	215	
Sand	62	277	
Black shale	38	315	
White slate	35	350	
Sand	60	410	
Slate	6	416	
Sand	16	432	
Slate (salt water)	6	438	

No. 12—James Goodin, No. 2.

Creek sand	15	15	
Slate	8	23	
Sand	19	42	
Slate	30	72	All Coal Measures and Conglomerate.
Sand	18	90	
Dark shale	65	155	
Lime	15	170	
Brown shale	20	190	
Lime	10	200	
Black shale	7	207	
"Wages" sand	61	268	Wages Sand.
Slate	80	348	
Sand	40	388	Stray Sand (?).
Slate	42	430	
Sand	54	488	Jones Sand.

No. 13—Mary Bartellow farm—Fighting Creek, east of No. 12.

Clay	18	18	All Coal Measures and Conglomerate.
Shale	180	198	
Lime	25	223	
"Wages" sand	90	313	Wages Sand.
Lime shale	105	418	
"Jones" sand (oil)	30	448	Jones Sand.

No. 14—H. P. Martin farm—Fighting Creek, six miles northeast of Barbourville.

Clay	20	20	
Sand	30	50	
Shale	60	110	
Sand	20	130	All Coal Measures and Conglomerate.
Slate	70	200	
Sand	90	290	
Slate	40	330	
Sand (gas)	80	410	
Slate	15	425	
Sand (salt water)	398	823	

No. 15—H. P. Martin, No. 2.

	Thickness.	Depth.	Geological Formation.
Quicksand	35	35	
Lime	5	40	
Shale	200	240	
Sand	15	255	All Coal Measures and Conglomerate.
Shale	50	305	
Sand	40	345	
Shale	60	405	
Sand	100	505	
Shale	40	545	
Sand	132	677	

No. 16—Decatur Jackson farm—Big Richland Creek.

Clay	10	10	All Coal Measures and Conglomerate.
Soapstone and quicksand	22	32	
Slate and soapstone	173	205	
Sand (salt water)	11	216	Wages (?).
Slate	14	230	
Sand	10	240	
Shale and sand shells	60	300	
Slate	60	360	
Sand	125	485	Jones (?).
Slate	6	491	
Sand (salt water)	54	545	
Slate	25	570	
Sand	30	600	Epperson (?).

No. 17—John J. Disney farm—Big Richland Creek.

Soil	15	15	All Coal Measures and Conglomerate.
Slate	40	55	
Sand	10	65	
Sand and shale	260	325	
Shale	70	395	
White sand	20	415	
Gray and black sand	145	560	
Light sand and pebbles	70	630	

No. 18—Decatur Jackson farm—Big Richland Creek.

Clay	10	10	
Quicksand	23	33	All Coal Measures and Conglomerate.
Soapstone	27	60	
Shale	140	200	
Sand (gas)	10	210	Wages (?).
Shale	15	225	
Sand	20	245	
Shale	20	265	
Shale	35	300	
Sand	22	322	
Shale	38	360	
White sand (salt water at 440)	212	572	Jones (?).
Black sand	22	594	
White sand	89	683	Epperson (?).
Coal	2	685	
Black sand	10	695	
White sand	10	705	

No. 19—J. W. Disney farm—Big Richland Creek.

	Thickness.	Depth.	Geological Formation.
Sand	30	30	
Shale	200	230	All Coal Measures and Conglomerate.
Sand (water)	12	242	
Shale	25	267	
Sand (gas and oil)	30	297	Wages (?).
Shale	50	347	
Sand	20	367	
Shale	53	420	
Sand	35	455	Jones (?).
Shale	30	485	
Sand	130	615	Epperson (?).
Shale	30	645	
Sand	10	655	

No. 20—Henry Stacy farm—Big Richland Creek.

Shale and sand shells	460	460	
Sand	180	640	All Coal Measures and Conglomerate.
Black slate	10	650	
Sand	74	724	

No. 21—Malinda Gray farm—Lynn Camp Creek, near Gray's Station.

Gravel and dirt	20	20	
Shale	50	70	All Coal Measures and Conglomerate.
Sand	48	118	
Shale	39	157	
Sand	25	182	
Shale	18	200	
Sand	40	240	Wages Sand (?).
Shale	128	368	
Oil sand	66	434	Jones Sand (?).

No. 23—Malinda Gray farm.

Gravel and sand	20	20	
Sand	60	80	
Shale	82	162	
Sand	53	215	
Shale	51	266	All Coal Measures and Conglomerate.
Sand	41	307	
Sand	123	430	
Sand	59	489	
Shale	12	501	
Sand	101	602	
Coal and shale	11	613	
Sand	59	672	
Sand	36	708	
Salt sand	13	721	

No. 24—Ralph Mays farm—Little Richland Creek, one and one-half miles north of Barbourville.

	Thickness.	Depth.	Geological Formation.
Sandy soil	35	35	
Sand rock	10	45	All Coal Measures and Conglomerate.
Black shale	155	200	
Slate and shale	85	285	
Sand (oil)	57	342	Jones Sand (?).

No. 25—N. B. Jones farm—Little Richland, four miles north of Barbourville.

Clay	25	25	
Sand	23	48	Coal Measures and Conglomerate.
Shale	100	148	
Sand	60	208	Wages Sand (?).
Shale	50	258	
Sand	25	283	
Shale	19	302	
Sand (oil)	20	322	Jones Sand (?).

No. 26—N. B. Jones farm, No. 2.

Clay	15	15	
Sand	70	85	
Shale	90	175	Coal Measures and Conglomerate.
Sand	27	202	
Shale	22	224	
Sand	59	283	
Sand	52	335	
Sand (oil)	69	404	Jones (?).

No. 27—N. B. Jones, No. 3.

Clay	35	35	
Sand	40	75	Coal Measures and Conglomerate.
Shale	90	165	
Sand	65	230	
Shale	30	260	
Sand	20	280	
Shale	30	310	
Sand	88	398	Jones Sand (?).

No. 28—N. B. Jones, No. 4.

Clay	25	25	
Sand	40	65	Coal Measures and Conglomerate.
Shale	100	165	
Sand	45	210	
Shale	80	290	
Sand	32	322	
Shale	13	335	
Sand	37	372	Jones Sand (?).

No. 29—Joseph A. Miller farm, north of No. 28—Little Richland Creek.

	Thickness.	Depth.	Geological Formation.
Dirt	20	20	
Shale	20	40	Coal Measures and
Sand	31	71	Conglomerate.
Shale	183	254	
Sand (water)	18	272	
Shale	36	308	
"Jones" sand	32	340	Jones Sand (?).

No. 30—Joseph A. Miller, No. 2.

Dirt	26	26	
Shale	20	46	Coal Measures and
Sand rock	24	70	Conglomerate.
Shale	200	270	
"Wages" sand	12	282	Wages Sand (?).
Shale	19	301	
Gray sand rock	7	308	Top of Jones Sand (?).

No. 31—Joseph A. Miller, No. 3.

Dirt	25	25	
Shale	21	46	Coal Measures and
Sand rock	23	69	Conglomerate.
Shale	204	273	
Sand (water)	15	288	Wages Sand (?).
Shale	20	308	
"Jones" sand	32	340	Jones Sand (?).

No. 32—Joseph A. Miller, No. 4.

Dirt and gravel	27	27	
Shale	15	42	Coal Measures and
Sand	20	62	Conglomerate.
Shale	180	242	
"Wages" sand	41	283	Wages Sand (?).
Shale	28	311	
"Jones" sand	64	375	Jones Sand (?).

No. 33—Joseph A. Miller, No. 6.

Clay	28	28	
Sand	42	70	Coal Measures and
Shale	85	155	Conglomerate.
Sand	30	185	
Shale	95	280	
Sand	18	298	Wages Sand (?).
Shale	32	330	
Sand	72	402	Jones Sand (?).

No. 34—J. W. Mills farm—Little Richland Creek, north of No. 33.

Soil and shale	170	170	Coal Measures and
"Wages" sand	25	195	Conglomerate.
Shale	110	305	Wages (?).
"Jones" sand	45	350	Jones (?).

No. 35—J. W. Mills, No. 2.

	Thickness.	Depth.	Geological Formation.
Clay	5	5	Coal Measures and
Sand	107	112	Conglomerate.
Shale	50	162	
Sand	40	202	Wages Sand (?).
Shale	70	272	
Sand	22	294	Stray Sand (?).
Shale	3	297	
Sand	13	310	Jones Sand (?).

No. 36—J. W. Mills, No. 3.

Clay	28	28	Coal Measures and
Sand	40	68	Conglomerate.
Shale	100	168	
Sand	45	213	Wages Sand (?).
Shale	80	293	
Shale	27	320	
Sand	19	339	Jones Sand (?).

No. 37—J. W. Mills, No. 4.

Clay	27	27	Coal Measures and
Sand	35	62	Conglomerate.
Shale	60	122	
Sand	70	192	Wages Sand (?).
Shale	70	262	
Sand	30	292	Stray Sand (?).
Shale	33	325	
Sand	121	446	Jones Sand (?).

No. 38—Thomas Gibson farm, north of No. 37—Little Richland Creek.

Clay	3	3	
Sand	15	18	Coal Measures and
Shale	15	33	Conglomerate.
Sand	12	45	
Shale	50	95	
Black shale	45	140	
Sand	30	170	Wages Sand (?).
Slate	110	280	
Sand	20	300	Jones Sand (?).

No. 39—Thomas Gibson, No. 2.

Clay	3	3	
Sand	15	18	Coal Measures and
Shale	15	33	Conglomerate.
Sand	12	45	
Shale	50	95	
Black shale	45	140	
Sand	30	170	Wages Sand (?).
Slate	110	280	
Sand (gas and oil)	83	363	Jones Sand (?).

No. 40—Thomas Gibson, No. 3.

	Thickness.	Depth.	Geological Formation.
Earth	10	10	Coal Measures and
Sand rock	10	20	Conglomerate.
Shale	140	160	
Sand	30	190	Wages Sand (?).
Shale	90	280	
"Jones" sand	68	348	Jones Sand (?).

No. 41—Thomas Gibson, No. 4.

Soil	25	25	
Shale	30	55	Coal Measures and
Sand	5	60	Conglomerate.
Shale	180	240	
Black sand	5	245	
Shale	35	280	
"Jones" sand (oil)	28	308	Jones Sand.

No. 42—Thomas Gibson, No. 5.

Surface sand	60	60	
White slate	20	80	Coal Measures and
White sand	20	100	Conglomerate.
Black slate	60	160	
"Wages" sand, broken	40	200	Wages Sand.
Black slate	85	285	
Stray salt sand	15	300	Stray Sand.
Black slate	15	315	
Black slate	5	320	
"Jones" sand (oil)	86	406	Jones Sand.

No. 43—Mary F. Hughes farm, one-quarter mile north of No. 42—Little Richland Creek.

Soil and sand	18	18	
Shale and slate	264	282	
White sand	60	342	
Oil sand	50	392	
Black slate	46	438	
White sand	132	570	
Oil sand	30	600	
Black slate	3	603	
White sand	8	611	
Black slate	40	651	
White sand	85	736	
Black slate	7	743	
Blue lime and sand	4	747	
White sand	62	809	
Black slate	5	814	
Blue or black slate	65	879	
Lime and sand	182	1,061	

No. 43—Mary F. Hughes, No. 2.

	Thickness.	Depth.	Geological Formation.
Clay	10	10	Coal Measures and
Sand	12	22	Conglomerate.
Slate	168	190	
Sand (little oil)	100	290	Wages Sand (?).
Slate	60	350	
Sand	165	515	Jones Sand (?).

No. 44—Si. Jones, No. 2, on Little Richland Creek, six miles from Barbourville and north of No. 43.

Clay	30	30	Coal Measures and
Slate	190	220	Conglomerate.
Sand	10	230	Wages Sand.
Slate	150	380	
Sand (oil)	80	460	Jones Sand.
Slate	40	500	
Sand	120	620	

No. 45—Si. Jones, No. 3.

Earth	22	22	Coal Measures and
Sand	10	32	Conglomerate.
Slate	342	374	
Sand	5	379	
Shale	2	381	
Sand	12	393	Jones Sand.

No. 46—Si. Jones, No. 4.

Clay	7	7	Coal Measures and
Sand	10	17	Conglomerate.
Slate	69	86	
Sand	9	95	
Sand (oil show)	18	113	Wages Sand (?).
Coal	1	114	
Shale	121	235	
Slate	25	260	
Sand	207	467	Jones Sand (?).
Slate	86	553	
Sand	55[2]	608[2]	Epperson Sand (?).

No. 47—Si. Jones, No. 6.

Earth and sand rock	10	10	Coal Measures and
Shale	30	40	Conglomerate.
Sand	10	50	
Shale	30	80	
Sand (gas)	8	88	Wages No. 1.
Black shale	172	260	
Sand	10	270	Wages No. 2.
Shale	167	437	
Sand (oil)	20[2]	457[2]	Jones.

No. 48—Si. Jones, No. 7.

	Thickness.	Depth.	Geological Formation.
Clay	10	10	Coal Measures and Conglomerate.
Sand	8	18	
Shale	85	103	
Sand	10	113	
Shale	270	383	
Sand (oil)	37	420	Jones Sand.

No. 49—Si. Jones, No. 8.

Clay	10	10	
Sand rock	20	30	Coal Measures and Conglomerate.
Black slate	20	50	
Sand (thick oil)	10	60	
Black slate	100	160	
Sand	10	170	
Black slate	80	250	
Sand	10	260	
Black slate	180	440	
Sand	15	455	
Black slate	16[2]	471[2]	

No. 50—Si. Jones, No. 9.

Clay	18	18	Coal Measures and Conglomerate.
Shale	430	448	
Sand and shale	21	469	
Shale	13	482	

No. 51—Si. Jones, No. 10.

Clay	4	4	Coal Measures and Conglomerate.
Sand	26	30	
Shale	50	80	
Sand	12	92	
Shale	73	165	
Sand	20	185	
Slate	40	225	
Hard shale	75	300	
Slate	190	490	
White sand, "Jones" (some oil)	5	495	Jones Sand.
Brown sand	2	497	
White sand, "Jones" (some oil)	3	500	
Slate	51[2]	551[2]	

No. 52—Si. Jones, No. 11.

Clay and quicksand	35	35	Coal Measures and Conglomerate.
Slate	115	150	
Sand	20	170	
Slate	55	225	
Sand	10	235	
Slate	11	246	
Sand	8	254	Wages Sand (?).
Slate	71	325	
Sand	8	333	Stray Sand (?).
Slate and shale	69	402	
"Jones" sand (oil and gas)	33	435	Jones Sand (?).

No. 53—Si. Jones, No. 12.

	Thickness.	Depth.	Geological Formation.
Clay	26	26	
Slate	132	158	Coal Measures and Conglomerate.
Sand	17	175	
Slate	61	236	
Sand	12	248	Wages Sand (?).
Slate	90	338	
Sand	12	350	Stray Sand (?).
Slate and shale	75	425	
Sand (some oil)	70	495	Jones Sand.
Slate	5	500	
Sand and oil	15	515	
Shale	35	550	
Sand	25	575	
Shale	50	625	
Sand	15	640	Epperson Sand (?).
Sand and oil	9	649	
Slate	1	650	

No. 54—John Wages farm, southeast of No. 53, on Little Richland Creek.
John Wages, No. 2.

Clay	9	9	
Shales	30	39	
Sand (black oil)	15	54	Wages No. 1.
Slate	50	104	
Sand	20	124	
Slate	20	144	
Sand (oil)	18	162	Wages No. 2.

No. 55—John Wages, No. 3.

Clay	9	9	
Shales	30	39	
Sand (black oil)	15	54	Wages No. 1.
Slate	50	104	
Sand	20	124	
Shales	20	144	
Sand (oil)	18	162	Wages No. 2.

No. 56—John Wages, No. 4.

Clay	9	9	
Shales	30	39	
Sand (black oil)	15	54	Wages No. 1.
Slate	50	104	
Sand	20	124	
Shales	20	144	
Sand (oil)	18	162	Wages No. 2.

No. 57—John Wages, No. 5.

Soil	10	10	
Soapstone	25	35	
Shale	120	155	
Sand	5	160	Wages No. 2.

No. 58—John Wages, No. 6.

	Thickness.	Depth.	Geological Formation.
Clay	15	15	
Slate	120	135	
Sand (oil)	15	150	Wages No. 2.

No. 59—John Wages, No. 7.

Clay and quicksand	18	18	
Sand	5	23	
Shale	120	143	
Sand	20	163	Wages Sand.
Shale	97	260	
Sand	18	278	Stray Sand.
Shale	27	305	
Sand	93	398	Jones Sand.
Slate	4	402	

No. 60—John Wages, No. 8.

Soil	10	10	
Sand	51	61	
Light shale	9	70	
Shale	60	130	
Light shale	41	171	
"Wages" sand (oil at 182)	29	200	Wages Sand.
"Wages" sand	36	236	
Shale	4	240	
Shale	6	246	
Sand	11	257	Stray Sand.
Shale	63	320	
"Jones" sand (oil at 322)	20	340	Jones Sand.
"Jones" sand (oil at 336)	18	358	
"Jones" sand	12	370	

No. 61—John Wages, No. 9.

Dirt and gravel	9	9	
Sand	49	58	
Shale	112	170	
"Wages" sand (show of oil)	28	198	Wages Sand.
Fire-clay	3	201	
Dark shale	41	242	
Light shale	66	308	
"Jones" sand (show of oil)	42	350	Jones Sand.
"Jones" sand	50	400	
Shale at bottom.			

No. 62—J. K. Payne farm, east of John Wages farm—Little Richland Creek.

	Thickness.	Depth.	Geological Formation.
Quicksand	10	10	
Sand	70	80	
Shale	20	100	
Sand	30	130	
Shale	50	180	
Sand, "Wages"	55	235	Wages Sand.
Shale	45	280	
Black sand (salt water)	20	300	Stray Sand.
Shale	18	318	
Sand	5	323	
Shale	10	333	
"Jones" sand (oil)	4	337	Jones Sand.

No. 63—J. K. Payne, No. 2.

Quicksand	18	18	
Sand	132	150	
Shale	30	180	
Sand	75	255	Wages Sand.
Shale	15	270	
Sand	10	280	
Shale	5	285	
Sand (salt water)	12	297	
Shale	30	327	
Sand (salt water)	13	340	
Shale	2	342	
Sand (salt water)	5	347	Jones Sand (broken).
Shale (some oil)	8	355	
Sand and shale	15	370	
Jones sand (oil)	11	381	

No. 64—J. K. Payne, No. 3.

	5	5	
Gravel	30	35	
Sand	15	50	
Shale	10	60	
Shale	25	85	
Sand	35	120	
Shale	40	160	
Shale or black sand	30	190	
Shale	100	290	
Shale	22	312	
Shale	33	345	
Shale	30	375	Jones Sand.
White sand (oil at 372)	12	387	
Sand			

No. 65—J. K. Payne, No. 4.

	Thickness.	Depth.
Dirt and gravel	4	4
Broken sand	11	15
Light slate	5	20
Gray sand	5	25
Bastard shale	25	50
Light shale	50	100
Dark gray sand or bastard lime	40	140
Black sand	10	150
Bastard shale	60	210
Gray sand	65	275
Light shale	3	278
Shale and sand	42	320
Dark shale	50	370
Dark shale	30	400
Gray sand	15	415
Dark sand	2	417

No. 66—Thomas C. Barnes farm, east of Wages farm—Little Richland Creek. Thos. C. Barnes, No. 2.

	Thickness.	Depth.	Geological Formation.
Clay and quicksand	12	12	
Shale and shells	183	195	
Sand (oil and water)	27	222	Wages Sand.
Shale	58	280	
Sand (oil)	8	288	Stray Sand.
Shale	47	335	
"Jones" sand (oil)	25	360	Jones Sand.
Bottom at		400	

No. 67—Thos. C. Barnes, No. 3.

Soil and quicksand	16	16	
Shale	29	45	
Sand	15	60	
Shale	210	270	
Sand	20	290	Wages (?).
Shale	128	418	
Sand	53	471	Jones (?).

No. 68—Thos. C. Barnes, No. 4.

Quicksand	18	18	
Slate	27	45	
Sand	20	65	
Slate	50	115	
Sand	20	135	
Slate	85	220	
Sand	8	228	
Shale	8	236	
Sand	25	261	Wages Sand (?).
Shale	117	378	
"Jones" sand	11	389	Jones Sand.
"Jones" sand (oil and salt water)	27	416	

No. 69—Thos. C. Barnes, No. 5.

	Thickness.	Depth.	Geological Formation.
Soil	20	20	
Soapstone	50	70	
Black slate	40	110	
White sand	20	130	
Soapstone	50	180	
Black sand	10	190	
Black slate	140	330	
Stray sand	10	340	
Soapstone	35	375	
"Jones" sand	30	405	Jones Sand.

No. 70—Thos. C. Barnes, No. 6.

Clay and quicksand	20	20	
Shale	20	40	
Sand	15	55	
Slate and shale	105	160	
Slate and shale	19	179	
Sand	15	194	
Slate	66	260	
Sand	12	272	Wages Sand (?).
Slate	73	345	
Hard shale	5	350	
Slate	48	398	
"Jones" sand	28	426	Jones Sand.
"Jones" sand (oil)	10	436	
Salt water sand	2	438	

No. 71—Thos. C. Barnes, No. 7.

Clay	16	16	
Slate and shale	184	200	
Sandy shales	17	217	Wages (?).
Slate	83	300	
Stray sand (oil)	10	310	Stray.
Slate	45	355	
"Jones" sand (oil)	18	373	Jones.

No. 72—Thos. C. Barnes, No. 8.

Clay	20	20	
Sand	30	50	
Slate	131	181	
Sand	15	196	
Slate	44	240	
Sand	20	260	Wages Sand.
Slate	35	295	
Sand	15	310	Stray Sand.
Slate	74	384	
Sand (oil)	69	453	Jones Sand.

No. 73—Ellen Jones farm, east of No. 72—Little Richla nd Creek.

	Thickness.	Depth.	Geological Formation.
Clay and quicksand	56	56	
Slate	87	143	
Sand	10	153	Wages Sand (?).
Shale	242	395	
"Jones" sand (oil)	15	410	Jones Sand.

No. 74—Ellen Jones, No. 2.

Quicksand	26	26	
Slate	54	80	
Sand	10	90	
Shale	38	128	
Slate	32	160	
Sand	15	175	
Shale	15	190	
Sand	15	205	
Shale and slate	35	240	
Hard shale	37	277	
Slate	103	380	
"Jones" sand (oil and gas)	15	395	Jones Sand.
Sand	49	444	

No. 75—Jones-Jarvis farm, part of Ellen Jones farm.

Quicksand	18	18	
Sand	20	38	
Shale	67	105	
Sand	6	111	
Shale	87	198	
Sand	28	226	Wages Sand (?).
Shale	142	368	
"Jones" sand (oil)	36	404	Jones Sand.

No. 76—Jones-Jarvis, No. 2.

Clay	20	20	
Sand	15	35	
Slate and shale	45	80	
Sand	15	95	
Shale	45	140	
Slate	113	253	
Sandy shale	17	270	Wages Sand (?).
Slate	90	360	
Shale	45	405	
Coarse sand, "Jones" (oil show)	15	420	Jones Sand.
Hard, white sand (salt water)	24	444	
Slate	1	445	

No. 77—Henry Jackson farm—Long Branch of Richland Creek.

	Thickness.	Depth.	Geological Formation.
Clay and gravel	13	13	
Sand	24	37	
Shale	48	85	
Shale	50	135	
Sand	15	150	Wages Sand (?).
Shale	95	245	
Sand	30	275	Stray Sand (?).
Shale	15	290	
Sand	101	391	Jones Sand (?).

No. 78—Henry Jackson, No. 2.

Clay	30	30	
Sand	35	65	
Shale	70	135	
Sand	112	247	
Sand	28	275	
Shale	24	299	
Sand	99	398	Jones Sand (?).

No. 79—George Jones farm—Caleb's Branch of Richland Creek.

Clay	10	10	
Sand	40	50	
Shale	250	300	
Sand	50	350	
Shale	85	435	
Sand (oil)	92	527	Jones Sand (?).

No. 80—George Jones, No. 2.

Shale and clay	160	160	
Shale	15	175	
Shale	180	355	
Sand	30	385	Wages Sand (?).
Slate	115	500	
Sand (oil show at 525)	100	600	Jones Sand (?).

In these records of Knox county wells, the dividing line between the Coal Measures and the Conglomerate can not be definitely drawn at present, but the wells are mostly in Conglomerate measures with some Coal Measure rocks at the top. The rocks in the Conglomerate are so extremely changeable here, that it is impossible to follow any sand with certainty from one locality to another, or even sometimes to carry a sand from one well to another on the same farm, therefore the limits ascribed in the above records to the two principal sands (Wages and Jones) are to be taken, in many of the records, as suggestive only. It is very doubtful, in fact, if these two sands are

in any measure continuous at all, and it is possible that oil may be struck in pools (generally small, because the sands themselves are not continuous over large areas) in any sand in the Conglomerate series, and that the presence or absence of an oil-bearing sand in any locality can only be told by drilling entirely through the Conglomerate series. It is evident from the records given, that only a very few wells have been drilled much more than half way through this formation, and it is also evident that some of them have stopped just short of where the horizon of the Jones sand should be, after going to a depth corresponding to the depth of the Jones sand in some nearby well.

WHITLEY COUNTY WELLS.

No. 1—Well at Halsey.

	Thickness.	Depth.	Geological Formation.
Drift	5	5	
Sand	10	15	
Dark clay shale	16	31	All Coal Measures and Conglomerate Series.
Light clay shale	16	47	
Light and dark shale	25	72	
Light sand	2	74	
Shaly sand	12[2]	86[2]	
Fine, massive sand	15[2]	102	
Sand and shale streaks	5	107	
Dark shale	5	112	
Dark, fine sand	1/3		
Dark shale	8 2/3	121	
Shale	1	122	
Dark shale and shaly sand	12 2/3	134 2/3	
Bastard lime	1/3	135	
Dark shale	2/3		
Bastard lime	1/3	136	
Dark shale	8	144	
Dark and light shale	5[2]	149[2]	
Soft, fine sand	1	150[2]	
Light sandy shale and sandstone	16[2]	167	
Dark clay shale	3	170	
Coal	1/6		
Fire-clay or clay shale	1/3		
Soft coal	3/4		
Dark clay shale	3/4	172	
Light clay shale	10	182	
Dark clay shale	12 2/3	194 2/3	
Coal	1	195 2/3	
Fire-clay	2 1/3	198	
Light clay and shale	8	206	
Shaly sandstone	5	211	

Halsey well—Continued.	Thickness.	Depth.	Geological Formation.
Coal	5/12		
Fire-clay	3/4		
Shaly sandstone	37 5/6	250	
Sandy shale	10	260	All Coal Measures and Conglomerate Series.
Dark cannel shale	10	270	
Fine light sand	4	274	
Sand	30	304	
Shaly sandstone	8	312	
Sand and shaly sandstone	24	336	
Shaly sandstone	3	339	
Shale	7	346	
Shaly sandstone	15	361	
Sandstone and shaly sandstone	8	369	
Sand	23	392	
Sand and shale	15	407	
Sand	5	412	
Coal	1	413	
Shale	1	414	
Dark, fine sand	11	425	
Dark sandy shale	16	441	
Sandy shale	3	444	
Sand	23	467	
Clay slate	18	485	
Coal and slate	1	486	
Fire-clay	1	487	
Slate	8	495	
Slate and coal	1	496	
Fire clay	1	497	
Slate	5	502	
Dark sandy slate	3	505	

No. 2—Williamsburg.

	Thickness.	Depth.
Soil	5	5
Sand and slate	140	145
Shale and shells	110	255
Black slate	147	402
Sand	185	587
Slate	15	602
Sand	15	617
Slate	80	697
White sand	25	722
Sand (gas)	62	784
Black shale and slate	19	803
Sand (oil)	172	975

Nearly all Conglomerate. The sands correspond approximately to those of Knox county.

CHAPTER VII.

PRODUCTION OF OIL AND GAS IN KENTUCKY.

The following figures, giving the annual production and market value of oil and gas in Kentucky, are taken from the reports by F. H. Oliphant, in "Mineral Resources of the United States," issued by the United States Geological Survey.

Oil.

Total production previous to 1883, 160,933 barrels.

Production from 1883 to 1901:

Year.	Barrels.
1883	4,755
1884	4,148
1885	5,164
1886	4,726
1887	4,791
1888	5,096
1889	5,400
1890	6,000
1891	9,000
1892	6,500
1893	3,000
1894	1,500
1895	1,500
1896	1,680
1897	322
1898	5,568
1899	18,280
1900	62,259
Total, 1883 to 1901	149,689

Production from 1901 to 1904:

Year.	Barrels.	Value.	Average price per barrel.
1901	137,259	$111,527.00	.813
1902	185,331	141,044.00	.76
1903	554,286	486,083.00	.877

Total reported production up to 1904.....1,026,565 barrels.

The production for 1904 is not given, but it was about twice that for 1903, and nearly equal to the total production of the State previous to 1904.

In all these figures, a small production from Tennessee is included.

Gas.

Value of the production from 1889 to 1904:

Year.	Value.
1889	$ 2,580
1890	30,000
1891	38,993
1892	43,175
1893	68,500
1894	89,200
1895	98,700
1896	99,000
1897	90,000
1898	103,133
1899	125,745
1900	286,243
1901	270,871
1902	365,611
1903	390,601

In the value for the years 1902 and 1903 a small production for Tennessee is included.

Value for 1904 not given.

CHAPTER VIII.

TRANSPORTATION OF OIL AND GAS.

Oil.

Previous to the completion of the pipe-lines, but little oil was marketed from the State, production and prospecting being both held back by the lack of transportation. Some oil was shipped by rail from such fields as were close to railroads, as, for instance, the Barren county field. The Sunnybrook field in Wayne county was connected by a two-inch line to the railroad at Somerset, and the Whitehouse field, in Floyd county, by a two-inch line to the Big Sandy river, but, outside of these three fields, but little oil was shipped. Plate No. 9 shows an attempt to market the Wayne county oil by transporting it in a line of barges down the Cumberland river to Nashville. The Cumberland Pipe Line Co. has now completed a system of pipe lines and storage tanks, which gives good service and handles the oil from all of the principal fields at present being operated, with the exception of the Barren county fields, which still ship their product by rail; the Irvine and Campton fields being only lately connected with the system.

Starting over the line in Tennessee, the pipe line runs through Wayne and Pulaski counties to the receiving tanks at Somerset, where tankage for some 200,000 barrels is provided. The line which starts at Cloyd's Landing, in Cumberland county, and takes the oil from that section, comes into the first line at a point west of Monticello, Wayne county. From the Somerset station, a four-inch line goes to the next receiving station, at Manchester, where a branch line from Barbourville, Knox county, comes in. The line then goes to the third receiving station at a point on the Licking river, just above Salyersville, Magoffin county, from which point a six-inch main takes the oil to the refineries of the Standard Oil Co. beyond Parkersburg, W. Va.

No. 9. Transporting oil in barges down the Cumberland river to Nashville.

No. 10. Train of tank cars loaded with Ragland Oil, at Salt Lick, Bath County.

A two-inch line starts at Irvine, Estill county, taking the oil from that field as far as Campton, Wolfe county, at which place it is increased to a four-inch line, and, taking the oil from there, joins the main line at a point in Morgan county, south of West Liberty. The two-inch line from the Whitehouse field to the Big Sandy river, has been taken up and now runs from the Whitehouse, or Floyd county field, to the main line at the Salyersville station. The oil from the Ragland field, in Bath county, was, for a time, taken by a branch line to the receiving station at Salyersville, but a part of the branch line has been taken up and the Ragland oil is now taken by a short pipe-line to the C. & O. Railroad at Salt Lick, Bath county, from which point it is shipped by rail. Plate No. 10 shows a train of tank cars at Salt Lick, loaded with Ragland oil.

As will be seen from the accompanying map (No. 1), this system, shown on the map by the green lines, not only provides transportation for oil from the fields now being operated, but is also available for possible future fields in a large area of contiguous territory, much of which has never been prospected. The system will doubtless be extended in the future as necessity may require.

Gas.

Only two of the known gas fields of the State are, as yet, connected with the market by pipe-lines, but there is, at least, a prospect of more lines being laid in the future.

A line was laid some years ago from the gas fields in Meade county to Louisville, and is still in use, while, more recently, the fields in Martin county were tapped by a line which runs down the Big Sandy river and supplies the towns of Louisa, Catlettsburg and Ashland, in Kentucky, Ironton in Ohio and Huntington in West Virginia. Both of these lines are shown (in red lines) on map No. 1.

CHAPTER IX.

MAPS.

Accompanying this bulletin are three maps of Kentucky. No. 1 shows the locations of producing oil fields and the pipe-lines for oil, in green; the locations of producing gas fields and the pipe-lines for gas, in red, and the outcrop lines of the Eastern and Western Coal-fields, showing their relation to the producing oil and gas fields. Map No. 2 shows the approximate outcrop of the Berea Grit and the area in Eastern and Northeastern Kentucky underlaid by it, as far as now known; also, the area in Southeastern Kentucky known to be underlaid by the Big Injun. As will be seen on the map, these two areas overlap in the extreme eastern part of the State. The direction of possible extensions of each of these areas is indicated by the broken lines of the corresponding conventions on the map. Map No. 2 also shows the approximate outlines of the area in Central Kentucky, where the Trenton rocks are at the surface, and from which they dip away to the east and west. Map No. 3 shows the outcrop lines of the Corniferous Limestone and, by the shaded part, the area under which it exists, as nearly as can be shown at present. The narrow belt occupied by the Corniferous in the southern part of Central Kentucky is shown, and its possible extensions under drainage, indicated by the broken lines.

The areas shown on Map No. 1, as producing, seem very small as compared with the remainder of the State. It should be borne in mind that only the locations of actual production are shown, with no attempt at outlining areas which may, or probably will, be productive. The same map will show, by contrast, the large areas which either have not been prospected at all, or else, which have been prospected to some extent, but not in a systematic or intelligent way. In this connection, it may be well to cite the area of the producing fields of Texas and Louisiana, which have produced enormous quantities of oil in the last few years. The returns for 1904, for the oil belt extending from Jennings, Louisiana, to Beaumont, Texas—a distance of about 125 miles—give a production of 26,053,044 barrels, while the total area of actual production in this belt is only about 700 acres.

APPENDIX.

Elevations Above Sea of Points in Kentucky.

Compiled from the various railroad and river surveys and the records of the Kentucky Geological Survey and United States Geological Survey.

Points marked with an * have been determined by barometric observation.

PLACE.	COUNTY	STATION	ELEVATION.
Adairville	Logan	L. & N. R. R.	589
Aden	Carter	C. & O. R. R.	626
Alexander	Fulton	I. C. R. R.	366
Allensville	Todd	L. & N. R. R.	554
Alms House	Jefferson	L. & N. R. R.	425
Alton	Anderson	S. R. R.	722
Anchorage	Jefferson	L. & N. R. R.	700
Anderson	Todd	E. & G. R. R.	650
Annora	Crittenden	I. C. R. R.	482
Arlington	Carlisle	B. M., near I. C. R. R.	363
Argyle	Powell	L. & E. R. R.	734
Ashbyburg	Hopkins		390
Ashland	Boyd	C. & O. R. R.	537
Athens	Fayette		1,006
Athol	Breathitt	L. & E. R. R.	746
Auburn	Logan	L. & N. R. R.	605
Augusta	Bracken	L. W. in Ohio River	444
Austerlitz	Bourbon	L. & N. R. R.	918
Avenstoke	Anderson	S. R. R.	733
Avon	Clark	L. & E. R. R.	973
*Backusburg	Calloway		430
Bagdad	Shelby	L. & N. R. R.	899
Baker's	Caldwell	I. C. R. R.	460
Bakersport	Hopkins	I. C. R. R.	426
*Baltimore	Hickman		412
*Bandana	Ballard		345
Bank Lick	Kenton	L. & N. R. R.	829
Barbourville	Knox	L. & N. R. R.	960
Bardstown	Nelson	L. & N. R. R.	637
Bardstown Junc.	Bullitt	L. & N. R. R.	417
Bardwell	Carlisle	I. C. R. R.	330
*Barlow	Ballard		420
Baskett	Henderson	L., H. & St. L. R. R.	397
Baugh	Logan	L. & N. R. R.	443
Beard's	Oldham	L. & N. R. R.	761
Beattyville	Lee	L. W. in Kentucky River	618
Beaver Dam	Ohio	I. C. R. R.	386
Beech Grove	McLean		408
Belcourt	Webster		397
Bellevue	Henry	L. & N. R. R.	875
Belmont	Bullitt	L. & N. R. R.	431
Belton	Muhlenberg	L. & N. R. R.	409
*Benton	Marshall		417
Berea	Madison	L. & N. R. R.	948
Berk City	Daviess		382
Berkeley	Carlisle	M. & O. R. R.	355
Berry	Harrison	L. & N. R. R.	640
Bethlehem	Hardin	I. C. R. R.	732
Bevier	Muhlenberg	L. & N. R. R.	400
Big Clifty	Grayson	I. C. R. R.	682
Big Sandy River	Boyd	L. W. at mouth	498
Big Sandy River	Lawrence	L. W. at mouth of Big Blaine	521
Big Sandy River	Lawrence	L. W. at Louisa	526
Big Sandy River	Martin	L. W. at mouth of Rockcastle	548

PLACE	COUNTY	STATION	ELEVATION.
Big Sandy River.	Martin	L. W. at Richardson	549
Big Sandy River.	Johnson	L. W. at mouth of Paint Cr.	587
Big Sandy River.	Martin	L. W. at Warfield	587
Big Sandy River.	Floyd	L. W. at mouth of John's Cr.	594
Big Sandy River.	Floyd	L. W. at Prestonsburg	606
Big Sandy River.	Floyd	L. W. at mouth of Mud Cr.	637
Big Sandy River.	Pike	L. W. at Pikeville	660
Big Sandy River.	Pike	L. W. at Breaks of Sandy	854
Big Spring	Bullitt	L. & N. R. R.	514
*Birmingham	Marshall		347
Blackford	Webster	I. C. R. R.	355
Blanchet	Grant	Q. & C. R. R.	953
*Blandville	Ballard		445
Bloomfield	Nelson	L. & N. R. R.	595
Bluff City	Henderson		394
Boaz	Graves	I. C. R. R.	387
Bond's	McCracken	I. C. R. R.	361
Boonesboro	Clark	L. W. in Kentucky River	538
Boone's Gap	Madison	L. & N. R. R.	1,130
Booneville	Owsley	L. W. in Kentucky River	651
Booth's	Hardin	L. & N. R. R.	425
Boston	Nelson	L. & N. R. R.	431
Bowling Green	Warren	L. & N. R. R.	469
*Boydsville	Graves		455
Bracht	Kenton	Q. & C. R. R.	919
Bradshaw	Todd	E. & G. R. R.	580
Brandenburg	Meade	L. W. in Ohio River	356
Brandenburg Sta.	Meade	L., H. & St. L. R. R.	594
Brannon	Jessamine	Q. & C. R. R.	1,041
Braxton	Mercer		863
Breaks of Sandy.	Pike	L. W. in Big Sandy River	854
Bristow	Warren	L. & N. R. R.	517
Broadhead	Rockcastle	L. & N. R. R.	903
Bronson	Pulaski	Postoffice	818
Brooks	Bullitt	L. & N. R. R.	490
Brownsboro	Oldham	L. & N. R. R.	770
Brumfield	Boyle	L. & N. R. R.	1,014
Brummit	Whitley	L. & N. R. R.	982
Buckner	Oldham	L. & N. R. R.	792
*Buena Vista	Graves		450
*Burdett's Knob	Garrard	Summit	1,090
Burgin	Mercer	Q. & C. R. R.	887
*Burkesville	Cumberland		630
Burnside	Pulaski	L. W. in Cumberland River	589
Burnside	Pulaski	Q. & C. R. R.	770
Butler	Pendleton	L. & N. R. R.	604
Calhoun	McLean		397
Calvary	Marion	L. & N. R. R.	609
Calvert	Marshall	I. C. R. R.	443
Campbellsburg	Henry	L. & N. R. R.	896
Cane Spring	Bullitt	L. & N. R. R.	623
Caneyville	Grayson	I. C. R. R.	399
*Carpenter's Sta.	Lincoln		1,060
Carrollton	Carroll	L. W. in Ohio River	413
Carrollton	Carroll	L. & N. R. R.	464
Catlettsburg	Boyd	L. W. in Ohio River	498
Catlettsburg	Boyd	C. & O. R. R.	544
Cave City	Barren	L. & N. R. R.	613
Cave Spring	Logan	L. & N. R. R.	588
Cayce	Fulton	M. & O. R. R.	400
Cecilian Junc.	Hardin	I. C. R. R.	637
Cedar Grove	Pulaski	Q. & C. R. R.	847
Central City	Muhlenberg	I. C. R. R.	400
Cerulean Springs.	Trigg	I. C. R. R.	447
Chenowee Tunnel.	Breathitt	L. & E. R. R.	938
Chicago	Marion	L. & N. R. R.	673
Chilesburg	Fayette	C. & O. R. R.	1,006
Christiansburg	Shelby	L. & N. R. R.	892
Clark	Shelby	S. R. R.	664
Clay City	Powell	L. & E. R. R.	646
*Clear Springs	Graves		360
Cleopatra	McLean		496
Clinton	Hickman	I. C. R. R.	354

PLACE	COUNTY	STATION	ELEVATION.
Cloverport	Breckenridge	L. W. in Ohio River	340
Cloverport	Breckenridge	L., H. & St. L. R. R.	387
Coalton	Boyd	C. & O. R. R.	603
Cobb's	Caldwell	I. C. R. R.	453
Colby	Clark	C. & O. R. R.	1,023
Colesburg	Hardin	L. & N. R. R.	425
*Columbia	Adair		756
Columbus	Hickman	L. W. in Mississippi River	270
Columbus	Hickman	R. R.	313
Concordia	Meade	L. W. in Ohio River	346
Conway	Rockcastle	L. & N. R. R.	951
*Coon Hollow	Nelson		570
Coraville	Henderson		412
Corbin	Whitley	L. & N. R. R.	1,046
Corinth	Grant	Q. & C. R. R.	953
Corydon	Henderson	I. C. R. R.	425
Cowan	Fleming	L. & N. R. R.	927
Covington	Kenton	L. & N. R. R.	525
Crab Orchard	Lincoln	L. & N. R. R.	919
Crayneville	Crittenden	I. C. R. R.	632
Crescent Hill	Jefferson	L. & N. R. R.	515
Crider	Caldwell	I. C. R. R.	455
Crittenden	Grant	Q. & C. R. R.	908
Cropper's	Shelby	L. & N. R. R.	889
Crow-Hickman	Daviess	L. & N. R. R.	380
Cumb. Falls Sta.	Pulaski	Q. & C. R. R.	1,256
Cumberland Gap.	Bell		1,665
Cumb'rland River	Pulaski	L. W. at mouth of Fishing Cr.	577
Cumb'rland River	Pulaski	L. W. at Burnside	589
Cumb'rland River	Pulaski	L. W. at m'th of Rockcastle R.	662
Cumb'rland River	Bell	L. W. at Pineville	951
Curdsville	Daviess		393
Curry	Mercer	S. R. R.	828
Cynthiana	Harrison	L. & N. R. R.	700
Danville	Boyle	Q. & C. R. R.	955
DeKoven	Union	I. C. R. R.	353
Delaware	Daviess		397
Denton	Carter	C. & O. R. R.	660
Dixon	Boone	Q. & C. R. R.	928
Donerail	Fayette	Q. & C. R. R.	882
Dry Ridge	Grant	Q. & C. R. R.	949
*Dukedome	Graves		450
Dulaney	Caldwell	I. C. R. R.	496
Duncannon	Madison	L. & N. R. R.	989
Dundee	Powell	L. & E. R. R.	724
Dunmor	Muhlenberg	L. & N. R. R.	574
Eagle	Carroll	L. & N. R. R.	465
Earlington	Hopkins	L. & N. R. R.	370
East Bernstadt	Laurel	L. & N. R. R.	1,159
*Eastin's Mill	Clark		700
East View	Hardin	I. C. R. R.	761
Eastwood	Jefferson	L. & N. R. R.	622
Ebenezer	Mercer		821
Eddyville	Lyon		436
Edwards	Logan	L. & N. R. R.	532
E. K. Junction	Carter	C. & O. R. R.	613
Ekron	Meade	L., H. & St. L. R. R.	627
Elizabethtown	Hardin	L. & N. R. R.	683
Elkatawa	Breathitt	L. & E. R. R.	748
Elk Chester	Woodford	S. R. R.	828
Elkton	Todd	E. & G. R. R.	602
Elliston	Grant	L. & N. R. R.	585
Eminence	Henry	L. & N. R. R.	922
English	Carroll	L. & N. R. R.	466
Enterprise	Carter	C. & O. R. R.	831
Epley's	Logan	L. & N. R. R.	661
Erlanger	Kenton	Q. & C. R. R.	905
Estill Furnace	Estill	Foundation	1,261
Eubanks	Pulaski	Q. & C. R. R.	1,172
Euterne	Henderson		457
Ewing	Fleming	L. & N. R. R.	903
Ewington	Montgomery	C. & O. R. R.	992

PLACE	COUNTY	STATION	ELEVATION.
Falls of Rough..	Breckenridge ...	L., H. & St. L. R. R.	423
Falmouth	Pendleton	L. & N. R. R.	530
Fariston	Laurel	L. & N. R. R.	1,116
Farmer's	Rowan	C. & O. R. R.	668
*Farmington	Graves		510
Filson	Powell	L. & E. R. R.	684
Fincastle	Lee	L. & E. R. R.	726
Finchville	Shelby	L. & N. R. R.	679
Fisherville	Jefferson	S. R. R.	540
Flat Lick	Knox	L. & N. R. R.	986
Flat Rock	Pulaski	Q. & C. R. R.	1,300
*Flemingsburg	Fleming		933
Florence	McCracken	I. C. R. R.	356
*Fordsville	Ohio		479
Fort Jefferson...	Ballard	I. C. R. R.	322
Frankfort	Franklin	L. W. in Kentucky River.	470
Frankfort	Franklin	Capitol steps	560
Franklin	Simpson	L. & N. R. R.	691
Fredonia	Caldwell	I. C. R. R.	394
Fulton	Fulton	I. C. R. R.	366
Gaither	Hardin	L. & N. R. R.	644
Garfield	Breckenridge ...	L., H. & St. L. R. R.	780
Gates	Rowan	C. & O. R. R.	819
Georgetown	Scott	Q. & C. R. R.	869
Gethsemane	Nelson	L. & N. R. R.	458
Gilbert's Cr. Sta.	Lincoln	L. & N. R. R.	830
Glasgow	Barren	G. R. R.	780
Glasgow Junc...	Barren	L. & N. R. R.	623
Glenavon	Clark	L. & E. R. R.	971
Glencairn	Wolfe	L. & E. R. R.	806
Glencoe	Gallatin	L. & N. R. R.	542
Glendale	Hardin	L. & N. R. R.	640
Glendeane	Breckenridge ...	L., H. & St. L. R. R.	433
Gordon	Muhlenberg	I. C. R. R.	429
Gracey	Christian	I. C. R. R.	495
Gravel Switch...	Marion	L. & N. R. R.	896
Grayson	Carter	E. K. R. R.	526
Grayson Sp. Sta.	Grayson	I. C. R. R.	658
Greendale	Fayette	Q. & C. R. R.	942
*Green River Knob	Casey	Summit	1,750
Greensburg	Green	L. & N. R. R.	581
Greenup	Greenup	L. W. in Ohio River	478
Greenville Sta...	Muhlenberg	I. C. R. R.	486
Greenwood	Pulaski	Q. & C. R. R.	1,203
Grove Center....	Union	I. C. R. R.	371
Gum Sulphur....	Rockcastle	L. & N. R. R.	878
Guston	Meade	L., H. & St. L. R. R.	671
Guthrie	Todd	L. & N. R. R.	517
Hadensville	Todd	L. & N. R. R.	534
Hall's Gap	Lincoln	L. & N. R. R.	993
Hamilton	Ohio	I. C. R. R.	442
Hampton	Boyd	C. & O. R. R.	540
*Hampton's Mill..	Morgan		733
Hanson	Hopkins	L. & N. R. R.	417
Harding	Union	I. C. R. R.	363
Hardinsburg	Breckenridge ...	L., H. & St. L. R. R.	700
*Harlan C. H.	Harlan		1,100
Harned	Breckenridge ...	L., H. & St. L. R. R.	720
Harris	Madison	L. & N. R. R.	1,009
Harrodsburg	Mercer	S. R. R.	824
Hatton	Shelby	L. & N. R. R.	693
Hawesville	Hancock	L., H. & St. L. R. R.	367
Hayden	Lincoln	L. & N. R. R.	823
Hazel Patch	Laurel	L. & N. R. R.	843
Hebbardsville ...	Henderson		421
Hedges	Clark	C. & O. R. R.	976
Hedgenville	Boyle		924
Helena	Mason	L. & N. R. R.	869
Hemp Ridge	Shelby	S. R. R.	731
Henderson	Henderson	L. W. in Ohio River	317
Henderson	Henderson	L. & N. R. R.	382
Henshaw	Union	I. C. R. R.	361

PLACE	COUNTY	STATION	ELEVATION.
Hickman	Fulton	L. W. in Mississippi River...	257
Hickman	Fulton	N. C. & St. L. R. R.	306
Hickory Grove...	Graves	I. C. R. R.	415
High Bridge	Jessamine	Q. & C. R. R.	762
High Bridge	Woodford	S. R. R.	706
Hillenmeyer	Fayette	Q. & C. R. R.	951
*Hillsboro	Fleming		1,030
Hinton	Scott	Q. & C. R. R.	943
Holt	Breckenridge ...	L., H. & St. L. R. R.	374
Hopewell	Greenup	E. K. R. R.	557
Hopkinsville	Christian	L. & N. R. R.	541
Horse Branch...	Ohio	I. C. R. R.	476
Horse Cave	Hart	L. & N. R. R.	603
Huber	Bullitt	L. & N. R. R.	458
Hunnewell	Greenup	E. K. R. R.	523
Hyattsville	Garrard	L. & N. R. R.	1,004
Independence	Kenton	L. & N. R. R.	752
Indian Fields	Clark	L. & E. R. R.	755
Irvine	Estill	L. W. in Kentucky River	571
Irvington	Breckenridge ...	L., H. & St. L. R. R.	577
Island	McLean	L. & N. R. R.	414
Jackson	Breathitt	L. & E. R. R.	762
Jeffersontown	Jefferson	S. R. R.	624
*Jeffersonville	Montgomery		856
Jellico	Whitley	L. & N. R. R.	937
Jericho	Henry	L. & N. R. R.	880
Jessamine	Jessamine	Q. & C. R. R.	886
Johnson	Fleming	L. & N. R. R.	898
Jolly	Breckenridge ...	L., H. & St. L. R. R.	652
Jordan	Fulton	M. & O. R. R.	404
Junction City	Boyle	Q. & C. R. R.	982
Kelly	Christian	L. & N. R. R.	681
Kenton Heights..	Kenton	Q. & C. R. R.	830
Kentucky River..	Carroll	L. W. at Carrollton	413
Kentucky River..	Carroll	L. W. at Pool 1	429.7
Kentucky River..	Owen	L. W. at Pool 2	442.7
Kentucky River..	Franklin	L. W. at Pool 3	455.5
Kentucky River..	Franklin	L. W. at Frankfort	470
Kentucky River..	Anderson	L. W. at Tyrone	483.7
Kentucky River..	Jessamine	L. W. at High Bridge	492
Kentucky River..	Jessamine	L. W. at Hickman Bridge	503
Kentucky River..	Fayette	L. W. at Clay's Ferry	533
Kentucky River..	Clark	L. W. at Boonesboro	538
Kentucky River..	Clark	L. W. at mouth Red River...	548
Kentucky River..	Estill	L. W. at Irvine	571
Kentucky River..	Lee	L. W. at Beattyville	618
Kentucky River..	Owsley	L. W. at Booneville	651
Kentucky River..	Perry	L. W. at m'th of Leatherwood.	1,019
Kentucky River..	Letcher	L. W. at mouth of Rockhouse.	1,079
Kentucky River..	Letcher	L. W. at mouth of Smoot's Cr.	1,145
Kentucky River..	Letcher	L. W. at Whitesburg	1,224
Kentucky River..	Letcher	L. W. at mouth Boone's Fork.	1,338
Kentucky River..	Letcher	Head in Payne's Gap	1,975
Kilgore	Carter	C. & O. R. R.	627
King's Mountain.	Lincoln	Q. & C. R. R.	1,168
Kinkaid	Scott	Q. & C. R. R.	862
Kirk	Breckenridge ...	L., H. & St. L. R. R.	689
Kirkwood	Mercer		852
Kuttawa	Lyon	I. C. R. R.	436
LaGrange	Oldham	L. & N. R. R.	841
Laketon	Carlisle	M. & O. R. R.	315
Lancaster	Garrard	L. & N. R. R.	999
L. & E. Junction.	Clark	L. & E. R. R.	956
L. & E. Tunnel..	Clark	L. & E. R. R.	1,006
Langford	Rockcastle	L. & N. R. R.	905
Lawrenceburg	Anderson	S. R. R.	770
Lawton's Bluff..	McCracken		455
Lebanon	Marion	L. & N. R. R.	754
Lebanon Junc...	Bullitt	L. & N. R. R.	429
Leitchfield	Grayson	I. C. R. R.	635
Leon	Carter	C. & O. R. R.	598
Lewis	Daviess	L. & N. R. R.	403

PLACE	COUNTY	STATION	ELEVATION.
Lewisburg	Mason	L. & N. R. R.	466
*Lewisburg	McCracken		365
Lewisport	Hancock	L. W. in Ohio River	333
Lexington	Fayette	L. & N. R. R.	946
Licking River	Kenton	L. W. at Covington	432
Licking River	Kenton	L. W. at DeCoursey	445
Licking River	Kenton	L. W. at Visalia	453
Licking River	Pendleton	L. W. at mouth South Fork	512
Licking River	Pendleton	L. W. at mouth North Fork	536
Licking River	Robertson	L. W. at Claysville	544
Licking River	Nicholas	L. W. at Lower Blue Lick	566
Licking River	Nicholas	L. W. at m'th of Big Fleming	577
Licking River	Nicholas	L. W. at Upper Blue Lick	592
Licking River	Bath	L. W. at mouth of Flat Cr	597
Licking River	Bath	L. W. at mouth of Slate Cr	623
Licking River	Bath	L. W. at mouth of Salt Lick	644
Licking River	Bath	L. W. at mouth of Beaver	676
Licking River	Morgan	L. W. at mouth of Elk Fork	733
Licking River	Morgan	L. W. at West Liberty	742
Licking River	Morgan	L. W. at mouth of White Oak	766
Licking River	Morgan	L. W. at mouth of Rockhouse	776
Licking River	Magoffin	L. W. at m'th of Johnson's Fk	806
Licking River	Magoffin	L. W. at mouth of Middle Fk	820
Licking River	Magoffin	L. W. at Salyersville	840
Lily	Laurel	L. & N. R. R.	1,072
Livermore	McLean	L. & N. R. R.	389
Livia	McLean	L. & N. R. R.	422
Livingston	Rockcastle	L. & N. R. R.	858
Lodiburg	Breckenridge	L., H. & St. L. R. R.	485
Logan	Shelby	L. & N. R. R.	613
London	Laurel	L. & N. R. R.	1,209
Long Branch	Meade	L., H. & St. L. R. R.	417
Long Grove	Hardin	I. C. R. R.	605
Long Run	Shelby	L. & N. R. R.	599
Loretto	Marion	L. & N. R. R.	711
Louisa	Lawrence	L. W. in Big Sandy River	526
Louisville	Jefferson	L. W. above Falls	386
Louisville	Jefferson	L. & N. depot	432
Louisville	Jefferson	J. M. & I. depot	457
*Lovelaceville	Ballard		350
Lowell	Garrard	L. & N. R. R.	799
Ludlow	Kenton	Q. & C. R. R.	535
Lyndon	Jefferson	L. & N. R. R.	537
Lynn Camp	Laurel	L. & N. R. R.	1,045
*Lynnville	Graves		481
McAfee	Mercer	S. R. R.	796
McBrayer	Anderson	S. R. R.	807
McHenry	Ohio	I. C. R. R.	434
*McKee	Jackson		1,040
McKinney	Lincoln	Q. & C. R. R.	1,008
McLeod	Logan	L. & N. R. R.	610
McNary	Muhlenberg	I. C. R. R.	427
Madisonville	Hopkins	L. & N. R. R.	460
Mahan	Whitley	L. & N. R. R.	899
*Manchester	Clay	L. W. in South Fork	882
Manitou	Hopkins	L. & N. R. R.	430
Marion	Crittenden	I. C. R. R.	571
Mason	Grant	Q. & C. R. R.	924
Massac	McCracken		450
Maurice	Kenton	L. & N. R. R.	498
Mayfield	Graves	I. C. R. R.	421
Mayo	Mercer		804
Maysville	Mason	L. W. in Ohio River	448
Maysville	Mason	L. & N. R. R.	525
Meadow Lawn	Bullitt	I. C. R. R.	422
Meade	Boyd	C. & O. R. R.	590
Mean's Tunnel	Carter	C. & O. R. R.	770
Memphis Junc.	Warren	L. & N. R. R.	533
Mercer	Muhlenberg	I. C. R. R.	471
Middlesborough	Bell	L. & N. R. R.	1,063
Midway	Woodford	S. R. R.	785
*Milburn	Carlisle		445
Millwood	Grayson	I. C. R. R.	603

PLACE	COUNTY	STATION	ELEVATION.
*Mintonville	Casey		1,185
Mississippi River	Fulton	L. W. at Hickman	256
Mississippi River	Hickman	L. W. at Columbus	270
Mississippi River	Ballard	L. W. at mouth Ohio River	272
Mitchellsburg	Boyle	L. & N. R. R.	969
Monterey	Owen	L. W. in Kentucky River	442
Monticello	Wayne		935
Montrose	Fayette	L. & E. R. R.	956
Mooresville	Washington	L. & N. R. R.	650
Moran's Summit	Madison	L. & N. R. R.	964
Morehead	Rowan	C. & O. R. R.	712
Moreland	Lincoln	Q. & C. R. R.	1,086
Morgan	Pendleton	L. & N. R. R.	610
Morganfield	Union	Q. & C. R. R.	398
Mortonsville	Woodford		789
Moscow	Hickman	M. & O. R. R.	313
*Mt. Carmel	Fleming		990
Mt. Guthrie	Rockcastle	L. & N. R. R.	1,121
Mt. Savage	Carter	C. & O. R. R.	601
Mt. Sterling	Montgomery	C. & O. R. R.	934
Mt. Vernon	Rockcastle	L. & N. R. R.	1,113
Muldraugh	Meade	I. C. R. R.	740
Muldraugh Hill	Hardin	L. & N. Tunnel	767
Muldraugh Hill	Marion	L. & N. R. R.	1,160
Munfordville	Hart	L. & N. R. R.	570
*Murray	Calloway		510
Music	Carter	C. & O. R. R.	692
Myers	Nicholas	L. & N. R. R.	613
Natural Bridge	Powell	L. & E. R. R.	765
Nazareth	Nelson	L. & N. R. R.	693
Nelson	Muhlenberg	I. C. R. R.	448
Nelsonville	Nelson	L. & N. R. R.	434
*New Concord	Calloway		460
New Haven	Nelson	L. & N. R. R.	444
New Hope	Nelson	L. & N. R. R.	488
Newport	Campbell	Madison street depot	511
Niagara	Henderson		477
Nicholasville	Jefferson	Q. & C. R. R.	945
Nolin	Larue	L. & N. R. R.	660
Normal	Boyd	C. & O. R. R.	539
North Fork	Boyle	L. & N. R. R.	934
Nortonville	Hopkins	I. C. R. R.	385
Norwood	Pulaski	Q. & C. R. R.	1,122
Nunn's	Crittenden	I. C. R. R.	357
Oakdale	Breathitt	L. & E. R. R.	796
Oakland	Warren	L. & N. R. R.	531
Oakton	Hickman	M. & O. R. R.	321
O'Bannon	Jefferson	L. & N. R. R.	731
*Ogden	Ballard		350
Ohio River		L. W. at mouth	272
Ohio River	McCracken	L. W. at Paducah	286
Ohio River		L. W. at Shawneetown	301
Ohio River	Union	L. W. at Raleigh	302
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PLACE	COUNTY	STATION	ELEVATION.
Ohio River	Greenup	L. W. at Greenup	478
Ohio River	Boyd	L. W. at Catlettsburg	498
Oil City	Barren	G. R. R.	610
Old Deposit	Jefferson	L. & N. R. R.	453
Olive Hill	Carter	C. & O. R. R.	752
Olmstead	Logan	L. & N. R. R.	563
Olympia	Bath	C. & O. R. R.	751
Orel	Jefferson	L. & N. R. R.	412
Ormsby	Jefferson	L. & N. R. R.	636
Otter Cr. Sta.	Hardin	I. C. R. R.	664
Otter Pond	Caldwell	I. C. R. R.	534
Owensboro	Daviess	L., H. & St. L. R. R.	367
Paducah	McCracken	L. W. in Ohio River	286
Paducah	McCracken	I. C. R. R.	341
Paint Lick	Garrard	L. & N. R. R.	794
Panther Cr.	Daviess	L. & N. R. R.	377
Paris	Bourbon	L. & N. R. R.	826
Parksville	Boyle	L. & N. R. R.	1,052
Payne's Gap	Letcher		1,975
Pembroke	Christian	L. & N. R. R.	562
Pendleton	Henry	L. & N. R. R.	830
Penick	Marion	L. & N. R. R.	930
Penrod	Muhlenberg	L. & N. R. R.	408
Petersburg	Christian	L. & N. R. R.	400
Pewee Valley	Oldham	L. & N. R. R.	753
Phillipsburg	Marion	L. & N. R. R.	704
Pierce	Breckenridge	L., H. & St. L. R. R.	407
Pikeville	Pike	L. W. in Big Sandy	660
Pinckard	Woodford		824
Pine Grove	Clark	C. & O. R. R.	960
Pine Hill	Rockcastle	L. & N. R. R.	966
Pine Knot	Whitley	Q. & C. R. R.	1,410
Pineville	Bell	L. & N. R. R.	999
Pisgah	Woodford	S. R. R.	846
Pleasant Valley	Rockcastle	L. & N. R. R.	1,110
Pleasant View	Whitley	L. & N. R. R.	971
Pleasure R. Park	Jefferson	I. C. R. R.	447
Pleasureville	Henry	L. & N. R. R.	882
Point Leavell	Garrard	L. & N. R. R.	884
Pound Gap	Letcher		2,512
Powers	Daviess	L., H. & St. L. R. R.	362
Preston	Bath	C. & O. R. R.	742
Prestonsburg	Floyd	L. W. in Big Sandy	606
Prewitt	Montgomery	C. & O. R. R.	1,054
Princess	Boyd	C. & O. R. R.	632
Princeton	Caldwell	I. C. R. R.	475
*Procter's Gap	Letcher		2,000
Pryorsburg	Graves	I. C. R. R.	411
Pulaski	Pulaski	Q. & C. R. R.	1,120
Quarry Switch	Bullitt	L. & N. R. R.	463
Quincy	Lewis	L. W. in Ohio River	464
Raleigh	Union	L. W. in Ohio River	302
Randolph	Jefferson	L. & N. R. R.	437
Red Hill	Hardin	I. C. R. R.	751
Red House	Madison	L. & N. R. R.	710
Red Oak	Logan	L. & N. R. R.	595
Reed	Henderson	L., H. & St. L. R. R.	379
*Reelfoot Lake	Fulton		290
Repton	Crittenden	I. C. R. R.	476
Ricedale	Muhlenberg	L. & N. R. R.	387
Richardson	Martin	L. W. in Big Sandy	549
Richmond	Madison	L. & N. R. R.	926
Rich Pond	Warren	L. & N. R. R.	564
Richwood	Boone	Q. & C. R. R.	924
Riley	Marion	L. & N. R. R.	914
Riverton	Greenup	E. K. R. R.	531
Robards	Henderson	L. & N. R. R.	413
Rockfield	Warren	L. & N. R. R.	568
Rock Haven	Meade	L., H. & St. L. R. R.	412
Rockhold	Whitley	L. & N. R. R.	955
Rockport	Ohio	I. C. R. R.	432
Rock Vale	Breckenridge	L., H. & St. L. R. R.	435
Rocky Hill	Edmonson	L. & N. R. R.	596
Rogers Gap	Scott	Q. & C. R. R.	913

PLACE	COUNTY	STATION	ELEVATION.
Rosine	Ohio	I. C. R. R.	546
Rosslyn	Powell	L. & E. R. R.	671
Rowland	Lincoln	L. & N. R. R.	844
Rowletts	Hart	L. & N. R. R.	610
Rumsey	McLean		384
Rush	Carter	C. & O. R. R.	628
Russellville	Logan	L. & N. R. R.	534
Ruth	Breckenridge	L., H. & St. L. R. R.	493
Sadieville	Scott	Q. & C. R. R.	857
St. Charles	Hopkins	I. C. R. R.	458
St. Joseph	Daviess		420
St. Mary	Marion	L. & N. R. R.	733
St. Mathews	Jefferson	L. & N. R. R.	522
St. Vincent	Union	I. C. R. R.	413
Salt Lick	Bath	C. & O. R. R.	656
Salvisa	Mercer	S. R. R.	758
Salyersville	Magoffin	L. W. in Licking River	840
Sample	Breckenridge	L., H. & St. L. R. R.	392
Samuels	Nelson	L. & N. R. R.	652
Sanders	Carroll	L. & N. R. R.	488
Sayers	Nelson	L. & N. R. R.	674
Science Hill	Pulaski	Q. & C. R R.	1,115
Scottsburg	Caldwell	I. C. R. R.	616
Scuffletown	Henderson		375
Sebree	Webster	L. & N. R. R.	362
Shelby Gap	Pike		1,431
Shelby Junc.	Jefferson	L. & N. R. R.	696
Shelbyville	Shelby	L. & N. R. R.	695
Shelbyville	Shelby	S. R. R.	684
Shepherdsville	Bullitt	L. & N. R. R.	426
Sherman	Grant	Q. & C. R. R.	924
Silver Cr. Sta.	Madison	L. & N. R. R.	804
Simpsonville	Shelby	L. & N. R. R.	771
Sinks	Rockcastle	L. & N. R. R.	906
Skillman	Hancock	L., H. & St. L. R. R.	387
Slaughter	Webster	L. & N. R. R.	380
Sloan's Valley	Pulaski	Q. & C. R. R.	912
Smithfield	Henry	L. & N. R. R.	875
Smith's Grove	Warren	L. & N. R. R.	607
Smithland	Livingston	L. W. in Ohio River	286
Somerset	Pulaski	Q. & C. R. R.	867
Sonora	Larue	L. & N. R. R.	699
South Carrollton	Muhlenberg	L. & N. R. R.	443
South Elkhorn	Fayette	L. & N. R. R.	895
South Fork	Lincoln		976
South Union	Logan	Q. & C. R. R.	579
Sparta	Gallatin	L. & N. R. R.	497
Spottsville	Henderson	L. & N. R. R.	366
Springfield	Washington		738
*Spring Hill	Hickman	L. & N. R. R.	450
Spring Lick	Grayson		387
Spurlington	Taylor	I. C. R. R.	981
*Standing Rock	Estill	L. & N. R. R.	1,269
Stanford	Lincoln		921
Stanley	Daviess	L. & N. R. R.	350
Stanton	Powell	L., H. & St. L. R. R.	671
*State House Rock	Estill	L. & E. R. R.	1,464
State Line	Christian		535
State Line	Whitley	L. & N. R. R.	1,350
Stephensport	Breckenridge	Q. & C. R. R.	390
Stepstone	Montgomery	L., H. & St. L. R. R.	777
Stevensburg	Hardin	C. & O. R. R.	611
Steubenville	Wayne	I. C. R. R.	887
Stine	Jefferson		484
Stithton	Hardin	S. R. R.	686
Strawberry	Jefferson	I. C. R. R.	432
Stroud	Muhlenberg	L. & N. R. R.	380
Sturgis	Union	L. & N. R. R.	363
Sullivan	Union	I. C. R. R.	365
Sulphur	Henry	I. C. R. R.	683
Summit	Whitley	L. & N. R. R.	1,263
Sutherland	Daviess	Q. & C. R. R.	378
*Symsonia	Graves	L. & N. R. R.	402

PLACE	COUNTY	STATION	ELEVATION.
Tallega	Lee	L. & E. R. R.	711
Talmage	Mercer		810
Tateville	Pulaski	Q. & C. R. R.	877
Taylorsville	Spencer	L. & N. R. R.	422
Thompson's	Montgomery	C. & O. R. R.	1,037
Thompson	Union	I. C. R. R.	408
Tip Top	Hardin	I. C. R. R.	760
Torrent	Wolfe	L. & E. R. R.	956
Tradewater	Hopkins	I. C. R. R.	456
Trenton	Todd	L. & N. R. R.	531
Triplett	Carter	C. & O. R. R.	950
Twin Tunnels	Muhlenberg	L. & N. R. R.	482
Tunnel Hill	Hardin	L. & N. R. R.	767
Turner's	Henry	L. & N. R. R.	740
Tyrone	Anderson	L. W. in Kentucky River	483
Union Mills	Jessamine		939
Uniontown	Union	I. C. R. R.	354
Uniontown	Union	L. W. in Ohio River	306
Upton	Larue	L. & N. R. R.	724
Valley	Jefferson	L. & N. R. R.	412
Valley Hill	Washington	L. & N. R. R.	572
Vanarsdell	Mercer	S. R. R.	765
Vanmeter	Fayette	S. R. R.	880
Veechdale	Shelby	S. R. R.	742
Verona	Boone	L. & N. R. R.	862
Versailles	Woodford	S. R. R.	910
Vine Grove	Hardin	I. C. R. R.	721
Viola	Graves	I. C. R. R.	400
Virden	Powell	L. & E. R. R.	666
Visalia	Kenton	L. W. in Licking River	453
Waddy	Shelby	S. R. R.	854
*Wadesboro	Calloway		442
*Wade's Gap	Clinton		1,310
*Walnut Flats	Lincoln		910
Walnut Grove	Caldwell		449
Walton	Boone	Q. & C. R. R.	912
Ward's	Carter	C. & O. R. R.	669
Warfield	Martin	L. W. in Big Sandy River	587
Warsaw	Gallatin	L. W. in Ohio River	411
Water Valley	Graves	I. C. R. R.	386
Waverly	Union	I. C. R. R.	408
Waynesburg	Lincoln	Q. & C. R. R.	1,215
Webster	Breckenridge	L., H. & St. L. R. R.	542
West Clifty	Grayson	I. C. R. R.	631
West Liberty	Morgan	L. W. in Licking River	742
West Louisville	Daviess		462
West Point	Hardin	I. C. R. R.	412
Whippoorwill	Logan	L. & N. R. R.	539
White Plains	Hopkins	I. C. R. R.	430
White's	Madison	L. & N. R. R.	903
Whitesburg	Letcher	L. W. in Kentucky River	1,224
White Sulphur	Caldwell	I. C. R. R.	480
Whitewood	Green	L. & N. R. R.	570
Whitley	Pulaski	Q. & C. R. R.	1,332
Wickliffe	Ballard	I. C. R. R.	322
Willard	Carter	E. K. R. R.	554
Williamsburg	Whitley	L. & N. R. R.	939
Williamstown	Grant	Q. & C. R. R.	943
Wilmore	Jessamine	Q. & C. R. R.	872
Wilson	Henderson	I. C. R. R.	377
Winchester	Clark	C. & O. R. R.	964
Winchester	Clark	L. & E. R. R.	980
Windom	Jessamine	Q. & C. R. R.	1,032
Wingo	Graves	I. C. R. R.	466
Wolf Lick	Logan	L. & N. R. R.	401
Woodbine	Whitley	L. & N. R. R.	1,080
Woodburn	Warren	L. & N. R. R.	610
Woodland	Hart	L. & N. R. R.	623
Woodlawn	Jefferson	L. & N. R. R.	509
Woodvale	Nelson	L. & N. R. R.	765
*Woodville	McCracken		440
Worthington	Daviess	L., H. & St. L. R. R.	382
Worthville	Carroll	L. & N. R. R.	478
Wright's	Taylor	L. & N. R. R.	616
Wyandotte	Clark	L. & E. R. R.	1,011
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